EXCESS PORE PRESSURE AND IN SITU MEASUREMENT

OF

SHEAR STRENGTH GAIN IN CLAYS

by

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

NOMENCLATURE

A	pore-pressure coefficient which represents the percentage of the deviator stress transmitted to the pore water within a sample
A°	angstrom
A_f	interparticle attractive forces
a_m	fraction of total interparticle area that is mineral-mineral contact
a_w	fraction of total interparticle area that is mineral-water or water-water contact
B	pore-pressure coefficient denoting the percentage of an applied, all-around pressure that is transmitted to the pore water within a sample
c	cohesion, total stresses
$\bar{c}$	cohesion, effective stresses
C_v	coefficient of consolidation
d	clay particle interplaner spacings (A°)
H	piezometric head
Log	common logarithm, $\log_{10}$
n	a whole number
R	interparticle repulsive forces
S	soil sensitivity
s	shear strength
u	total pore pressure
u_a	pore-air pressure
u_w	static pore-water pressure
Δ_u	excess hydrostatic pore pressure
γ_t	total unit weight of soil

γ_b buoyant unit weight of soil

γ_w unit weight of water

ϵ compressive shear strain

θ angle between the incident beam and the atomic plane in an X-ray diffraction test

λ x-ray wave length

σ_n total normal stress

$\bar{\sigma}_n$ effective normal stress

$\bar{\bar{\sigma}}$ mineral-mineral contact stress

σ_1 axial stress in triaxial tests (or major principal stress)

σ_3 all-around stress in triaxial tests (or min. principal stress)

$\sigma_1 - \sigma_3$ deviator stress

$\Delta\sigma_1$ increase in the major principal stress caused by the embankment loading

$\Delta\sigma_3$ increase in the minor principal stress caused by the embankment loading

ϕ angle of shearing resistance, total stresses

$\bar{\phi}$ angle of shearing resistance, effective stresses

ABSTRACT

This study compares predicted and field measured excess pore pressures in a soft, saturated clay subjected to an embankment loading. It compares the increases in soil strength due to consolidation as measured with in situ vane shear, unconfined compression, and triaxial test methods. The predicted pore pressures were obtained from the equation:

$$\Delta_u = B\left[\Delta\sigma_3 + A\left(\Delta\sigma_1 - \Delta\sigma_3\right)\right]$$

The A and B parameters in the equation were determined from triaxial pore pressure measurements. The principal incremental stresses $\Delta\sigma_1$ and $\Delta\sigma_3$ were obtained using the Finite Element and Elastic Theory methods of stress analysis. The influence of the loading rate, soil consolidation, and permeability on pore pressure development were also investigated. Field pore pressures were measured with hydraulic and pneumatic type piezometers.

The results indicate that there is reasonably close agreement between the predicted and field measured pore pressures using stresses determined by the Finite Element method. The predicted pore pressures determined ty the Elastic Theory method were considerably higher than the measured pore pressures. The equation used for predicting pore pressures assumes no pore pressure dissipation during construction. This assumption was shown unvalid for soils in this area because there was a continuous dissipation of pore pressure during embankment construction.

The in situ vane shear test values were nearly of the same magnitude as those obtained by the conventional unconfined compression and triaxial test methods, except for soft to very soft clays where the vane shear

test results were considerably higher. For soft to very soft clays the triaxial and the vane test results were in close agreement but the samples in triaxial tests had to be initially back pressure saturated and then completely consolidated under the in situ overburden pressure. The increase in soil strength due to consolidation was not constant for all soils. Some clays gained more strength than the others for equal consolidation pressures. Quick clays lost strength during the initial stages of soil consolidation. With the exception of soft to very soft clays most clays developed about 70 percent of their ultimate strength gain during the initial 40-50 percent soil consolidation. In soft clays most of the strength gain took place during the final stages of soil consolidation.

INTRODUCTION

Few theories developed for predicting behavior of soils under foundation loading have been verified through observation. To close the gap between theoretical and practical soil mechanics, observational data are required for validation of theoretical relationships.

Construction of embankments on soils of low shear strength requires knowledge of the rate of strength gain as the pore water pressure caused by embankment loads dissipates. Currently, there is not adequate experimental data verifying the amount and rate of strength gain due to pore pressure dissipation. The assumed shear strength gain used in a foundation analysis is based on theory and laboratory testing, both of which must be verified through field observations.

In shear analysis, one must use pore pressures measured in laboratory tests for predicting the behavior of a foundation during construction. The difficulties lie in obtaining laboratory pore pressures which can be used to predict pore pressures induced by embankment loads in the field, and to predict soil strength gain during construction. Both pore pressure estimates and increases in soil strength are significant factors in embankment design and in predicting the performance of a foundation.

Statement of the Problem

Pore fluids (air and water) do not resist deformation or shearing stresses. The resistance to shear in a mass of soil is developed by the effective strength. The effective strength depends on the amount of pore pressure developed and consequently dissipated. If the effective shearing strength of a foundation soil under an embankment can be readily determined from vane shear tests and field pore pressure measurements, embankment loading rates can be more accurately established. In other words, vane shear tests and field pore pressure measurements could be made prior to and at various stages of embankment construction. Whenever the effective shear strength of the soil reached a value which would indicate a stability factor in excess of unity the embankment loading could continue. The method thus developed will enable engineers to predict stability (or instability) of a foundation at any time during construction; thus providing better controlled loading rates and insuring embankment stability. The method would preclude the necessity of relying entirely on pore pressure measurements for predicting the point at which the soil approaches incipient failure. This procedure will make it possible for embankments to be safely and economically constructed over soft saturated clays in shorter periods of time than have previously been possible. Currently, construction of embankments is stopped when field pore pressure readings reach 60 to 80 percent of the induced pressure. This method of controlling loading rates is entirely hypothetical and is not based on field or laboratory measurements of pore pressure at failure. In the past many embankments have failed because of lack of knowledge of strength change during construction.

Objectives of the Study

The objectives of this study are: (1) to compare predicted and field measured excess pore pressures in a saturated clay foundation, and (2) to use a field vane shear device in conjunction with field installed piezometers to measure the effective strength developed in weak layers of saturated clay subjected to embankment loads. After a construction shutdown the rate of pore pressure increase with increasing stresses ($\frac{\Delta_u}{\Delta\sigma_1 - \Delta\sigma_3}$) is believed to be less than the increase prior to construction shutdown (1, 2, 27). This is a significant factor in shear analysis which will also be evaluated in this study.

Scope of the Study

The excess pore pressure induced in a clay foundation is determined from the equation (53):

$$\Delta_u = B\left[\Delta\sigma_3 + A\left(\Delta\sigma_1 - \Delta\sigma_3\right)\right]$$

where Δ_u is the excess pore pressure, $\Delta\sigma_1$ and $\Delta\sigma_3$ the increases in major and minor principal stresses, and A and B are the pore pressure parameters. In this study the A and B parameters were determined from pore pressure measurements obtained from triaxial shear tests. The triaxial tests were performed on Shelby tube samples taken from the Parish Lane embankment area located north of Bountiful, Utah. Prior to embankment construction 14 piezometers were installed in the test area. These samples were taken from the same location and elevations where the piezometers were installed. The principal stresses $\Delta\sigma_1$ and $\Delta\sigma_3$ were determined using the Finite Element and Elastic Theory methods. The analysis was limited to comparison of the predicted pore pressures based on Skempton's formula and the pore pressure values obtained in the field with piezometers.

Three pore pressures may exist in a mass of soil. These are: (1) pore air pressure, (2) capillary pressure which is a negative pressure, and (3) positive pore water pressure. Only the pore water pressure was measured in this study. The pore air and capillary pressures were eliminated by back pressure saturation (30). The application of back pressure causes air bubbles in the pore space to be dissolved in the pore water resulting in complete soil saturation. When a complete saturation is reached, the capillary and air pore pressures become zero.

The amount and rate of increase in strength determined by field tests are compared with the amount and rate of increase in strength determined by laboratory triaxial and unconfined compression tests.

The rate of pore pressure dissipation is compared with the rate of shear strength gain.

Variations in the pore pressure parameter A are discussed in relationship with depth and soil properties within a soil layer.

LITERATURE REVIEW

Effective and Neutral Stresses

The principle of effective stress in relationship with soil shear strength is commonly presented by the equation:

$$s = \bar{c} + \left(\sigma_n - u\right) \tan \bar{\phi} = \bar{c} + \bar{\sigma}_n \tan \bar{\phi}$$

Where s is the maximum shear stress on the failure plane, $\bar{c}$ the effective cohesion, $\bar{\phi}$ the effective angle of internal friction, and $(\sigma_n - u)$ the effective normal stress $\bar{\sigma}_n$. The effective stress principle was discovered by Casagrande (47), Hvorslev (20), and Terzaghi (5, 20, 23, 28) who found that the maximum shear resistance s on a failure plane is a function of the total stress σ_n on that plane minus the pore pressure u. Rendulic (44), Bishop and Elden (3), Laugthon (26), and Bishop and Bjerrum (5), among others, have confirmed the validity of the effective stress principle through experiments and observations.

However, in partially saturated soils because of air-water interfaces and menisci formation, the situation is somewhat different. Formation of menisci introduces capillary pressures in clay which may have a significant effect on the effective stress (5, 48). The effective stress for these types of soils is given (4) by the equation:

$$\bar{\sigma}_n = \sigma_n - u_a + x\left(u_a - u_w\right)$$

where σ_n is the total normal stress, u_a the pore air pressure, u_w the pore water pressure, and x a parameter which depends on the degree of soil saturation. For saturated soils x is unity and for dry soils x is zero. In this study the insitu soils are known to be saturated hence the above equation becomes: $\bar{\sigma}_n = \sigma_n - u_w$

For zero loading conditions, with water table at the ground surface and assuming no ground water movements, the pore pressure u_w at a point below the ground surface is equal to the piezometric head H times the unit weight of water γ_w. The pore pressure for this case (u_w) is called the neutral or hydrostatic pressure. The effective stress $\bar{\sigma}_n$ then becomes equal to the buoyant unit weight of the soil γ_b times the thickness H of the overlying soils (48, 58), or,

$$\bar{\sigma}_n = \gamma_t H - \gamma_w H = H\left(\gamma_t - \gamma_w\right) = H\gamma_b$$

If the ground water is not at the surface the effective stress $\bar{\sigma}_n$ becomes equal to the total stress above the water table plus the effective stress below the water table.

When a clay foundation is loaded, the $\bar{\sigma}_n$ and u_w values in the above equation are increased. The increased value of the pore pressure (Δ_u) is called "excess hydrostatic pore pressure" and is presented as:

$$\Delta_u = u - u_w = u - \gamma_w H$$

where u is the total pressure in the pore water. The remaining fraction of the induced stress, that which is not applied to pore water, is transmitted to soil particles and is called the effective stress (21, 23, 58).

Shear Strength Parameters

The shear strength of cohesive soils has been a subject of controversy since the inception of soil mechanics principles. This is primarily because of the number and complexity of factors involved. These factors are mostly interrelated and it has been difficult to isolate one factor without affecting the others. Factors such as the effective stress (15, 50, 61); cohesion and friction (4, 50); bonds between clay particles (19, 35); the properties of adsorbed water (49, 51); electrolytes and electrical double layers (59); and the structure of clays, their formation, and particle associations (59, 62) have been extensively investigated but they are not yet completely understood.

In practice the shear strength in clays is commonly presented in the form of Coulomb's equation which divides the shear strength into cohesional and frictional components as expressed in the equation:

$$s = c + \sigma_n \tan \phi$$

where c denotes cohesion, σ_n the normal stress on the failure plane, and ϕ the angle of internal function. Contrary to present concepts, earlier investigators were convinced that the c and ϕ components were constant for a given soil (47). However, this concept was gradually changed and the equation was modified. As mentioned earlier, Casagrande (47), Terzaghi (28, 23, 5), and Hvorslev (20)were the first to observe that pore pressure occurs in soils upon shearing and should be included in Coulomb's equation. They suggested that the normal stress σ_n in Coulomb's equation be replaced by the intergranular stress $\bar{\sigma}n$ where $\bar{\sigma}n = \bar{\sigma}n-u$, u being the pore pressure. Hence, Coulomb's equation was modified to read as follows: $s=\bar{c} + (\sigma_n - u) \tan \bar{\phi}$. Further, the shear strength in clay is a function of the test conditions, percent saturation, preconsolidation pressure, nature of the pore fluids, temperature, loading rate, soil geometrical structure, and the void ratio (19, 50, 52, 61). The nature of these elements and their effects on soil shear strength have been discussed in several recent studies (17, 19, 31, 50). The effects of moisture and temperature on soil behavior are elaborated upon because of the growing interest by researchers in recent studies and because of their significant influence on clay behavior.

Cohesion - Cohesion (c) is defined as the shear resisting force that exists between soil particles; that is the force which can be mobilized between soil particles if the effects of all the external forces were removed (24, 50). Mobilization is defined as the activation of shear strength due to applied shear stresses. Cohesion is derived from Van der Waals attractive forces, Coulombic forces existing between positively and negatively charged particles, from exchange forces resulting from electron sharing between two adjacent atoms, from weaker forces such as the hydrogen bond, and from cementing agents like carbonates, iron oxides or certain organic compounds (19, 33, 50, 59). Studies by Lambe (25) and Rosenquest (46) indicate that the intensity of the attractive forces decreases as the distance between clay particles increases. The distance between soil particles depends on the void ratio, the geometrical arrangement, and the effective stress (19).

There are also repulsive forces between soil particles which tend to decrease interparticle attractive forces. These are the forces derived from the electrical double layers (59) surrounding clay particles.

Therefore, cohesion would be the net attraction between attractive and repulsive forces plus the resisting force derived from the cementing agents.

The nature of the attractive and repulsive forces and their role in the shear strength of clays are amply discussed by Seed, et al. (50), Lambe (24), Van Olphen (59), Hvorslev (19), and Whitemen (61), among others.

Friction - Friction is the resistance to shear derived from granular particles in a soil. The magnitude of this factor depends on the intergranular pressures, extent of interlocking of particles, nature of packing, specific surface area of the particles, particle size, mineralogical composition of the particles, relative compactness and stress history of the soil (19, 24, 50). The maximum frictional strength developed in a mass of soil also depends on the magnitude of the pore pressure developed. With the increase of pore pressure, the frictional component $(\sigma_n - u) \tan \phi$ in Coulomb's equation (page 5) is decreased. The factors involved in frictional force derivations are discussed in detail by Hvorslev (19), Lambe (24), and Seed (50).

In general, the factors controlling the strength of cohesive soils may be presented by Lambe's equation (24) which states that for saturated soils the effective normal stress is $\bar{\sigma}_n = \bar{\bar{\sigma}} a_m + R - A_f$. This is derived from the equation $\bar{\sigma}_n = \sigma_n - u$ by assuming $\sigma_n = \bar{\bar{\sigma}} a_m + u a_w + R - A_f$ and $u = u a_w$.

In Lambe's terms

σ_n = total normal stress

$\bar{\sigma}_n$ = effective normal stress

$\bar{\bar{\sigma}}$ = mineral-mineral contact stress

a_m = fraction of total interparticle area that is mineral-mineral contact

u = water pressure

a_w = fraction of total interparticle area that is mineral-water or water-water contact

R = total interparticle electrical repulsion divided by total interparticle area

A_f = total interparticle attraction divided by total interparticle area

Lambe's equation gives a simplified picture of the forces involved between soil particles. It also indicates that it is difficult, if not impossible to divide these forces into cohesional and frictional components as treated earlier.

Water - Water content, not so apparent from Coulomb's equation, is an important factor in reducing the shear strength (9, 18, 35). Clays loose strength rapidly when the moisture content is increased. One possible explanation is that the addition of water increases clay interparticle spacings which reduces the intensity of the attractive forces and the number of bonds (35) existing between clay particles. Experiments by Mitchell et al. (35) indicate that the compressive strength in soils is proportional to the number of bonds per unit contact area. Bonding is assumed through solid-solid contact and each bond is assumed to have equal strength. The addition of water reduces these bonds rapidly. Test results by Mitchell et at. (35) indicate that there is a linear relationship between the moisture content and the logarithm of the number of bonds from air-dry to a completely saturated clay. It was further reported that the number of bonds per unit area of dried clay was appoximately 100 times larger than that of wet clay. Hence, moisture content appears to have a significant effect in reducing clay shear strength.

Some investigators believe that there is no effective contact between clay particles because of the free and adsorbed waters surrounding clay particles (19, 35, 39, 45). The adsorbed water, also called "oriented" or "solid-like" water is believed to have somewhat differnet properties than free water. Martin (32) for example, suggests that the adsorbed water is more viscous and more disordered. Because of the adsorbed water clay particles are kept separated from each other and the adhesive force between clay particles is reduced (19, 50). More adhesion would have existed if the adsorbed water was removed. Others (39, 42) believe that the adsorbed water has little effect, if any, on the shear strength.

Temperature - Temperature changes influence soil behavior more than has been commonly accepted. Soil samples are at times subjected to large temperature changes when removed from the ground, exposed to air temperature, and then tested in a laboratory under a different temperatue. Yet, laboratory tests are not designed to consider these changes. Laguros (22) and Lambe (24) report that at high temperatures soils display an increase in shear strength. According to Lambe, the increase in temperature depresses the electrical double layer which increases the attractive forces. Others like Mitchell (36) and Marshall (33) indicate that an increase in temperature reduces the shear strength by increasing the pore pressure. Campanella and Mitchell (9) indicate that one degree Fahrenheit change in temperature changes the effective stress by approximately 0.75-1 percent of the initial effective stress. For less compressible soils, the change in the effective stress was greater.

Generally clays behave visco-elastically (49) under external loading, and such behavior is usually affected by a change in the temperature. In certain situations if the change in temperature is not considered, it would produce significant engineering implications. For example, samples obtained at a structure site during winter months may be subjected to substantial temperature changes when they are tested in the laboratory.

Shear Strength Gain Due to Consolidation

The shear strength in clays is a function of the effective stress, the mineralogical composition, the ions in the pore and adsorbed water, and the geometric structure. Changing any one of these elements could influence soil behavior, but changes in the effective stress $\bar{\sigma}$ and the void ratio are believed to be the primary factors responsible for the changes in soil mechanical behavior. This is evident from the equation $s = c + \bar{\sigma}_n \tan \bar{\phi}$ where by changing the c and $\bar{\sigma}_n$ components the shear strength is changed. An increase in the effective stress is believed to increase soil intergranular frictional forces while a decrease in void ratio is believed to increase interparticle attractive (or cohesional) forces. In practice both these changes are obtained through consolidation. The exact nature of the cohesional forces and their function in increasing the soil strength is not clearly known, but some observers believe that consolidation has comparatively little effect on cohesional forces as compared to frictional forces (35, 38). The works of Mitchell et al. (35) have shown that clays gain strength through increase in the number of bonds at interparticle solid-to-solid contacts, and that the number of bonds at any contact is proportional to the effective consolidation pressure $\bar{\sigma}_n$. No indication was made of an increase in the interparticle attractive forces. Morgenstern (38) through reviewing the works of Morgenstern and Tchalenko (37), Mead (34), and Olson and Mitronovas (40) derives a similar conclusion. He points out that the mechanical properties of clays are governed mainly by conditions at interparticle contacts; long range interparticle forces are only responsible for the particle arrangements when the clay is formed.

Some investigators point out the possibility of clays not gaining but loosing strength during consolidation. This could be due to viscous reaction to stress or due to breaking of clay structure. Crawford (10), for example, reports that breaking of bonds in some clays may lead to exceptional loss of strength. Scott et al. (49) also mention the possibility of strength loss due to breaking of soil structures.

In some soils the frictional component $(\sigma_n - u)\tan\emptyset$ is very small and the resistance to shear is primarily due to cohesional forces. In these soils, during the initial stages of consolidation part of the applied stress is transferred to clay contact areas where the cohesional forces are present. The applied stresses eventually overcome the cohesional forces and the soil collapses due to breaking of soil structure. If this is the case, some clays could loose considerable strength upon breaking particle associations at contact area. Quick or sensitive clays are good examples. These clays are commonly deposited in marine waters where they become coagulated by sodium chloride and other salts in solution and rapidly settle. Removal of these salts by natural leaching (28, 46, 43, 29) or by a dispersant such as humic acid (28) increases the thickness of the electrical double layer and reduces the forces that hold clay particles together. The attractive forces are reduced but the soil structure essentially remains the same. Now a disturbance, such as the stress applied through consolidation, could break-up clay particle association and collapse the soil structure (28, 10). Clays in Jordan Valley, where this study was conducted, are in this category. They have been leached by a slow upward flow of water existing in the area in the form of ground water near the mountains on the east or as perched or artesian aquifers in the valley. On the other hand, leaching could increase the strength by reducing the pH value and increasing the eH value (29). A decrease of pH in the pore water promotes disintigration of the minerals and release of free cations (29). Potassium, iron, and aluminum by cation adsorption increase the plasticity index which results in an increase in the shear strength. Calcium, iron, and aluminum also increase the shear strength by precipitating as cementing agents.

Pore Pressure Parameters A and B

Skempton's equation $\Delta_u = B\Delta\sigma_3 + AB(\Delta\sigma_1 - \Delta\sigma_3)$ is used in this study in estimating the pore pressures. Δ_u is the pore pressure, $\Delta\sigma_1$ and $\Delta\sigma_3$ the applied major and minor principal stresses, and A and B are the pore pressure parameters.

Parameter A represents the percentage of the deviator stress, $\sigma_1 - \sigma_3$, transmitted to the pore water within a sample. A is a variable and its magnitude depends on stress and strain conditions for a given soil (23). Table 1 represents A factors as determined by Skempton (53) and Bjerrum (6) for different clayey soils at failure.

Table 1. Values of the Pore-Pressure Parameter A as obtained by Skempton and Bjerrum

Type of Clay	Skempton	Bjerrum
Sensitive Clays	+0.75 to +1.5	+1.2 to +2.5
Normally Consolidated Clays	+0.5 to +1	+0.7 to +1.3
Lightly Over-consolidated Clays	0 to +0.5	+0.3 to +0.7
Heavily Over-consolidated Clays	-0.5 to 0	-0.5 to 0
Compacted Sandy Clays	+0.25 to 0.75	

Parameter B is a ratio denoting fraction of an applied, all-around pressured that is transmitted to the pore water within a sample. B is 1.0 for completely saturated soils and it is less than one for partially saturated soils. It is zero for dry soils.

Parameters A and B are dimensionless numbers which are determined from triaxial undrained tests.

TEST SITE

The area considered for this study is in Davis County, Utah about 7 miles north of Salt Lake City. The site consists of two 50 foot high 56 foot wide approach embankments which are to carry Parish Lane over I-15. The terrain is essentially flat but gently sloping towards the Great Salt Lake on the west. The area is marshy with surface water occurring during the spring and early summer. Surface drainage is to the west. A map of the area is shown in Figure 1.

The area was chosen for this study because of its weak subsoils. The soils are extremely soft and plastic. Circular slope stability analysis, using the total-stress method, indicated failures for fills exceeding 25 feet. The soils are relatively impervious, and time-settlement calculations indicated more than 5.9 years to obtain 100 percent primary consolidation for a 40 foot high embankment.

Geology

Great Salt Lake is a remnant of the fresh water Lake Bonneville which covered the area during much of the Pleistocene Epoch. Lake Bonneville at its maximum extent occupied an area of approximately 20,000 square miles. It extended to Western Utah and parts of Idaho and Nevada. Its surface was once nearly 1000 feet above the existing lake. The test area is located between the Wasatch Range on the east and the east shore of Great Salt Lake on the west. The mountains consist mainly of consolidated rock of Precambrian and Cambrain age (67). West of the mountains is marked with the Precambrian Farmington formation overlain with thick layers of alluvial fans and Ancient Lake Bonneville terraces.

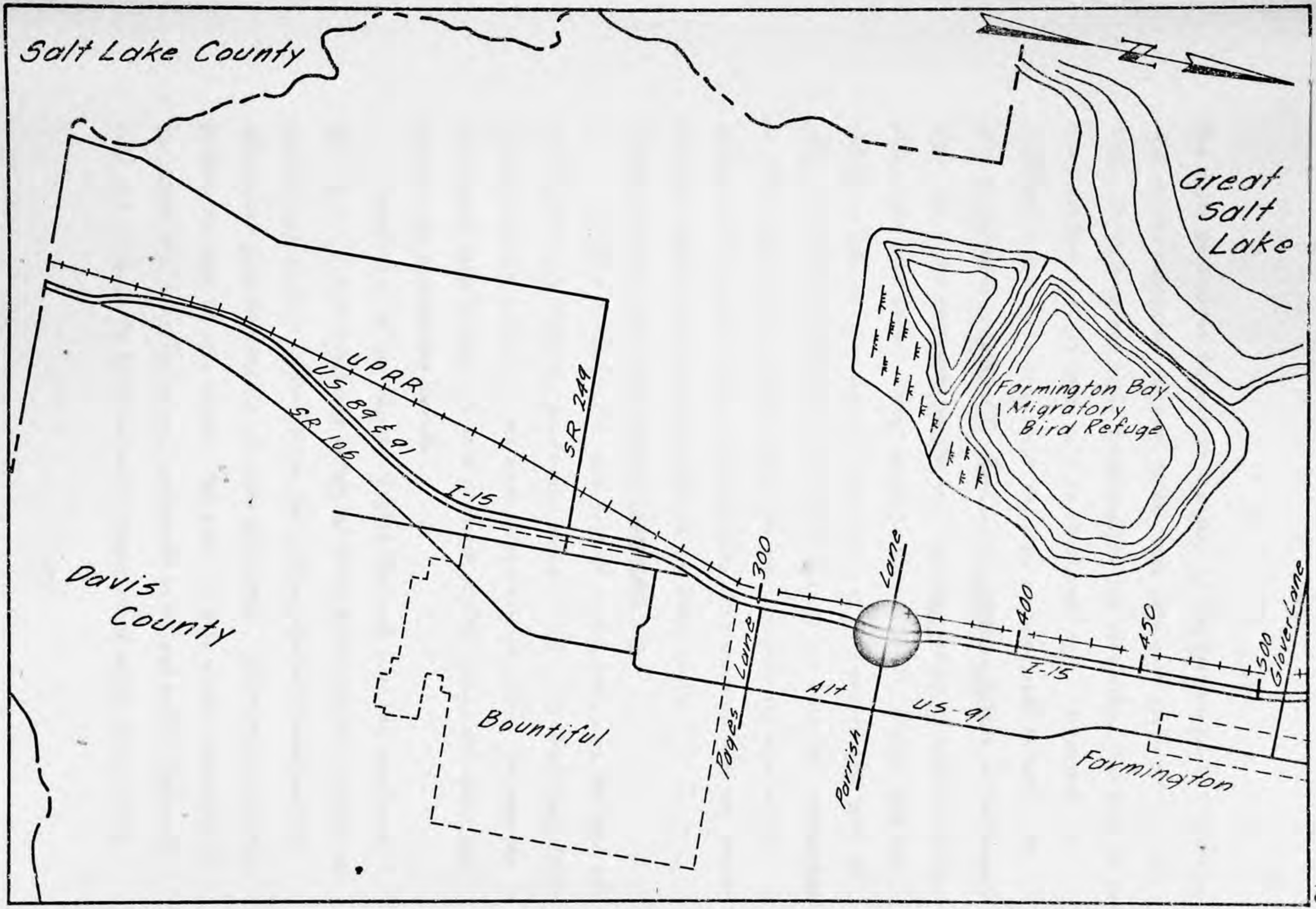


FIG. 1. PARRISH LANE TEST AREA MAP

The major geological feature in the area is the Wasatch Fault traversing west of the mountains and east of the test area in a north south direction. It is a normal fault downthrown to the west side. The dips on the fault surface vary 20 to as much as 70 degrees (67). Breaching the terraces is the basin area where the lake sediments are formed. The lake basin appears to have received sediments through much of Quaternary time (65). The sediments in the basin consist mainly of plastic silts, clays, and some sands. Other deposits such as salts, oolite, and calcareous algae are also found in the area. It is reported (66) that 20 percent of the lake deposits consisted of clays and colloids transported by lake currents, 44 percent clays and some colloids transported by wind, and 36 percent chemical precipitates that occurred when the receding lake became saturated with calcium and other salts.

Subsoil Physical and Mineralogical Characteristics

A total of 39 test holes were drilled in the test area for soil investigation and sampling, piezometer installations, and vane shear tests. A truck mounted rotary rig was used in these operations. The samples were taken with 2 and 2 3/8 inch diameter Shelby tubes, and water was used as the circulation medium.

Correlation of the subsoils within the test area was very good. The top 2 - 4 feet consisted mainly of sandy silty topsoil. Below the topsoil and to 30 - 35 feet below the surface the soil consisted of silty clay with laminations of silty fine sand. There were occasional pockets of sand in this layer. The soils in this layer, according to the AASHO Soil Classification, are mainly A-7-6 and A-7-5. Below 35 feet and to about 70 feet the soils consisted of silty sand, clayey silt, and silty clay with A-1-b, A-6(12), and A-6(10) classification. A generalized profile of the subsoils is shown in Figure 2.

The clayey soils between 3 and 35 feet, where this study is mainly concentrated, were very soft and compressible as revealed by their low shear strength and the standard blow count measurements. The standard blow counts ("N" Values) recorded from penetration samplings were in the range of 2 to 6 blows per foot and the shear strength values were as low as 0.2 TSF. The plastic and liquid limits of these soils were high with moisture contents frequently reaching to 50 percent. A summary of gradation analysis, Atterberg limits, water content, unit weight, and other tests are given in appendix 1.

X-ray and chemical analysis were performed in determining soil mineral composition. Table 2 represents a summary of the findings. The techniques used in X-ray and chemical analysis are presented under Laboratory Apparatus and Testing Section, pages 34-35. As indicated in the table the soil is predominantly composed of quartz, about 55.6 percent. The remaining 44.4 percent is composed of Fe_2O_3 (5.6%), Al_2O_3 (14.2%), CaO (7.3%), MgO (3.1%), Na_2O (1.0%), K_2O (2.3%), CO_2 (5.2%), H_2O (2.3%), organics (3.2%), and soluble salts (0.9%). It is noteworthy to observe that the salinity of the soil is less than 1 percent, and that of the pore water is less than 0.05 percent. Indicating that if there were any salts in the soil, they were removed through leachings. This could be the possible cause of sensitive clay conditions in the area. Leaching is believed to reduce soil pH value. The average pH value recorded is 8.6 which is considered somewhat basic. A decrease in the pH value indicates chemical weathering and strengthening of the soil (29). The

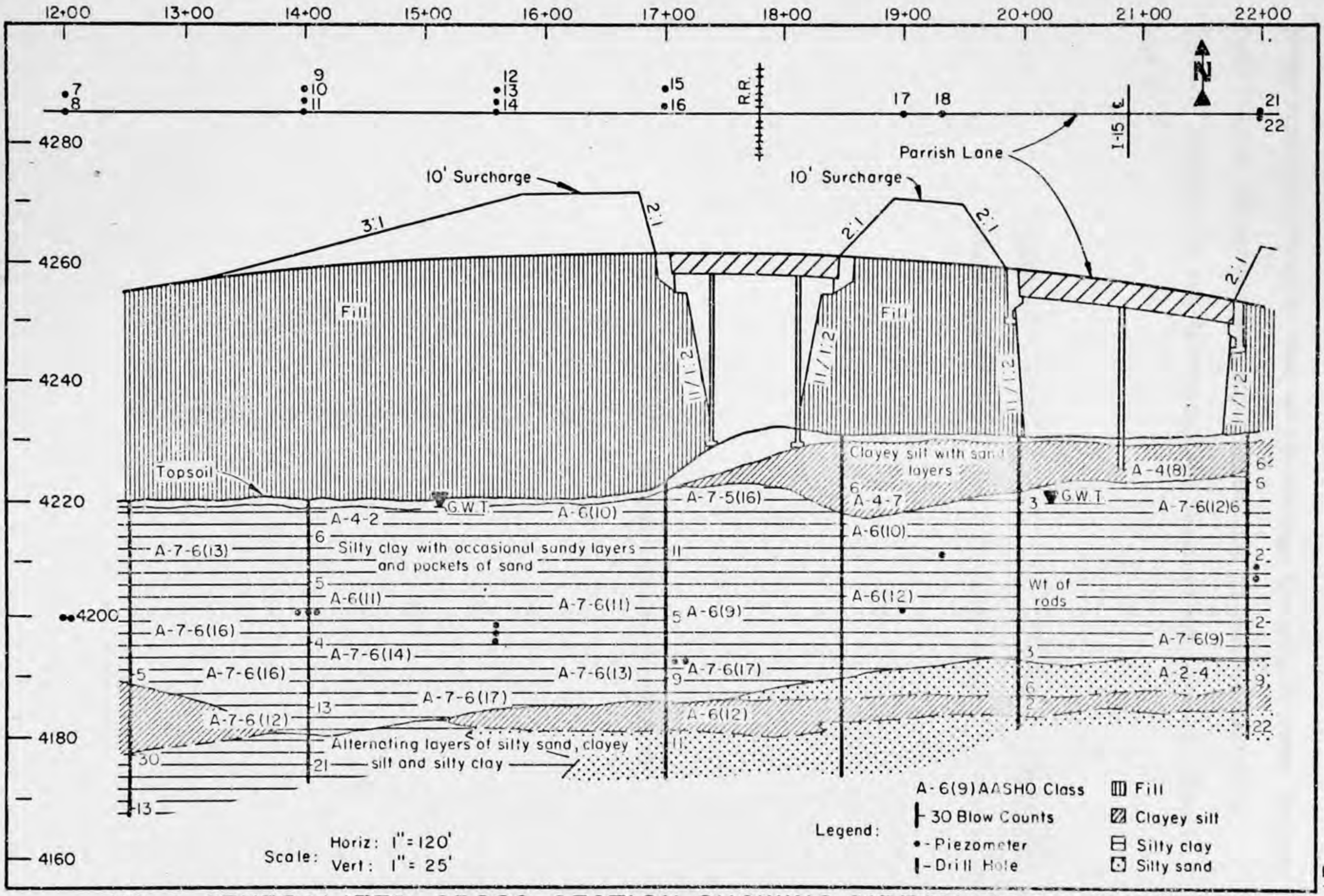


FIG. 2 GENERALIZED CROSS SECTION SHOWING PIEZOMETER LOCATIONS

X-ray analysis indicates that on the average the soil is about 66 percent illite, 18 percent montmorillonite, and 15 percent kaolinite. Typical examples of the diffractograms obtained are shown in Figures 3 and 4.

TABLE 2 CHEMICAL AND X-RAY ANALYSIS OF SOIL SAMPLES

T. H. Sta.	T. H. No.	Depth Ft.	CHEMICAL ANALYSIS, %													X-Ray Analysis, %		
			SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	Na_2O	K_2O	CO_2	H_2O	organics	Sol. Salts.	pH	Sol Salts in H_2O	Illite	Kaol.	Mont.
11+30	15	14														86	12	2
		19	56.4	5.1	13.5	7.6	3.0	0.8	2.4	5.9	2.3	2.7	0.5	8.4		53	14	34
12+70	9	17												8.7	0.07			
		30	55.0	5.8	14.7	7.0	3.0	0.9	2.1	5.4	2.5	3.0	0.9	8.6				
13+80	10	33.5													0.05			
14+10	11	24	55.0	5.8	14.7	7.0	3.0	0.9	2.1	5.4	2.5	3.0	0.9	8.6	0.05	65	10	26
		30	53.5	4.6	13.2	8.2	3.2	0.9	2.4	6.5	2.0	4.1	1.0	7.4		62	13	24
		35	60.9	5.3	12.8	5.2	3.1	0.8	2.5	1.6	1.8	5.2	1.0	7.8	0.05	66	12	22
15+60	12	20	56.3	5.5	14.1	7.0	3.1	1.1	2.2	4.5	2.2	3.3	0.9	8.1	0.06	63	7	30
		25	57.3	5.8	14.6	6.2	3.0	1.2	2.3	3.9	2.4	2.4	1.1	7.2		67	15	19
		30	51.8	4.2	13.6	9.7	3.1	0.9	2.3	6.9	2.4	4.2	0.9	8.1	0.04	69	20	10
16+53	14	19	58.7	6.5	15.4	3.0	3.2	1.5	2.3	1.8	4.1	3.0	0.9	8.1	0.09	61	20	19
		24	58.8	5.3	14.5	6.0	2.8	1.2	2.3	4.1	1.9	2.5	1.1	7.5	0.05	67	20	13
		29	55.0	4.3	13.0	9.0	3.1	0.8	2.5	7.1	1.9	2.5	0.9	8.1	0.05	76	22	2
22+30	13	15	52.0	5.1	16.3	8.5	3.1	0.9	2.4	6.1	2.2	3.2	1.1	7.9	0.05			
		20	52.6	4.6	13.4	9.8	3.0	0.7	2.3	7.6	1.9	2.9	1.2	7.9	0.05	69	12	19
		24	55.8	5.2	13.9	7.7	3.3	0.8	2.4	6.1	1.8	2.2	0.8	8.2	0.04	60	21	20
Average			55.6	5.2	14.2	7.3	3.1	1.0	2.3	5.2	2.3	3.2	0.9	8.6	0.05	66	15	18

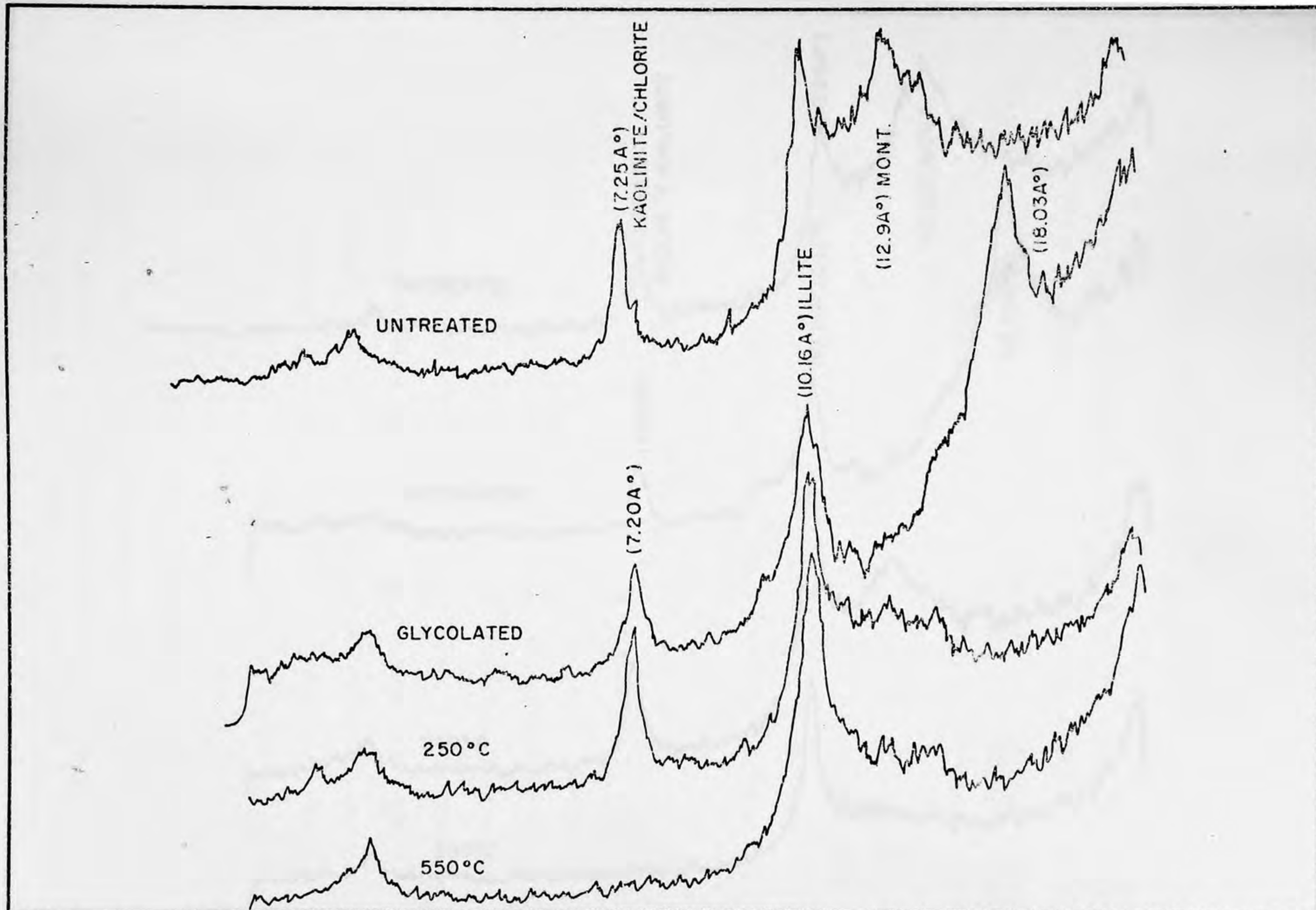


FIG. 3 X-RAY DIFFRACTOMETER TRACES OF A CLAY SAMPLE FROM PARRISH LANE STATION 14+10, DEPTH 35 FEET

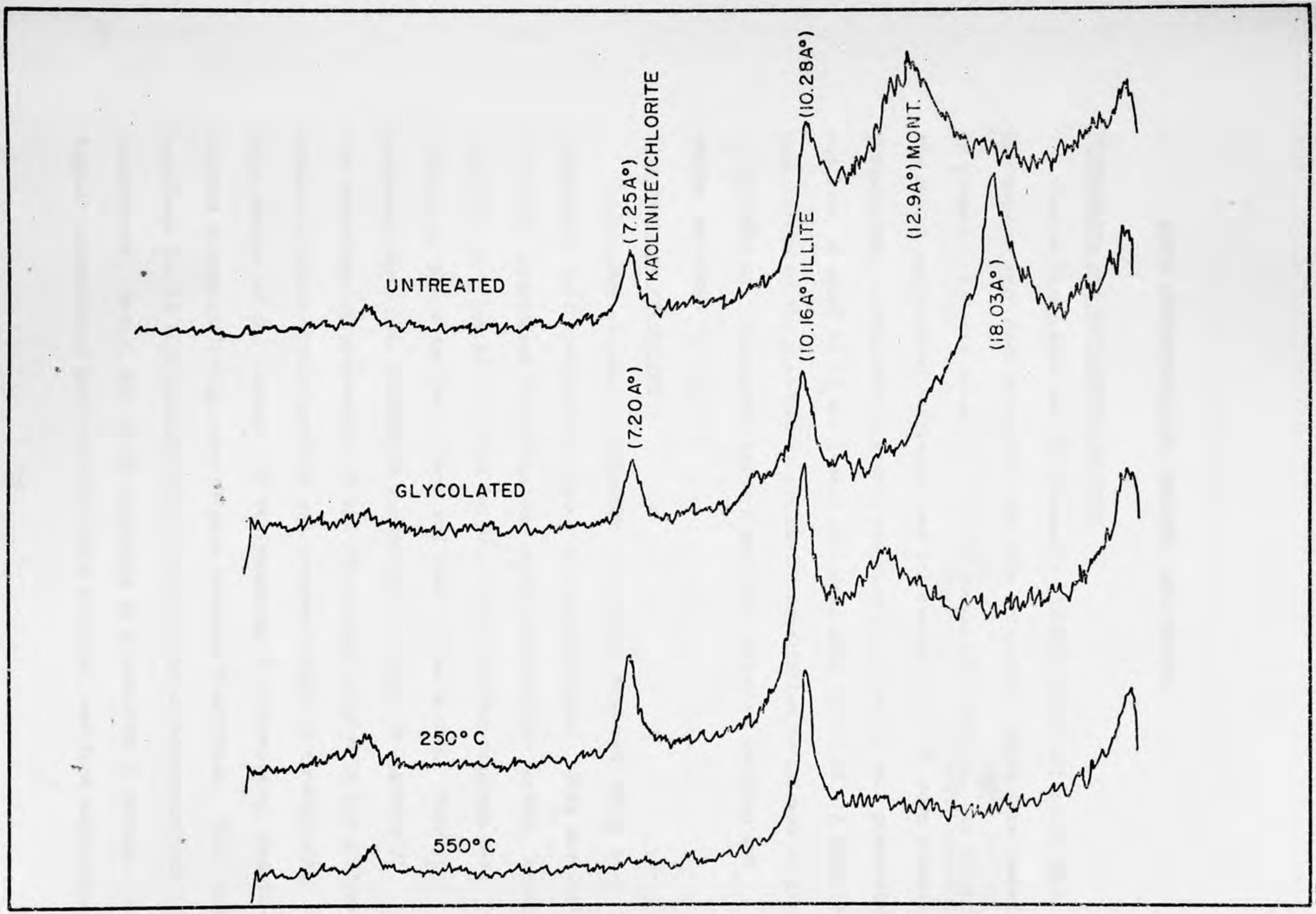


FIG. 4 X-RAY DIFFRACTOMETER TRACES OF A CLAY SAMPLE FROM PARRISH LANE STATION 15+16, DEPTH 20 FEET

FIELD INSTRUMENTATION, LOADING, AND TESTING

Piezometers and Settlement Platforms

Twelve Casagrande and two pneumatic (51402, Slope Indicatior Co.) piezometers were used to monitor the pore pressures. These were installed in groups of two and three (p. 21) for comparison purposes. To observe the amount and rate of settlement and its correlation with pore pressure dissipation, a settlement platform was also installed at each piezometer station. A total of 12 settlement platforms were installed. A detailed description of the piezometers and their installation techniques is given in Appendix II. Piezometer numbers and their relative location and depths are shown in Figure 2.

Pore Pressure Recordings

Field pore pressure (piezometer) recordings were made after each incremental fill loading or as often as every two hours. This required 4-6 daily piezometer recordings during the construction period. After the fills were placed to design height, the piezometer readings were limited to once a day for 25 days and then to once a week. Graphical presentations of the piezometer recordings are given in Appendix II. The recordings of piezometers 17 and 18 are not included in the analysis because of construction problems and frequent delays in constructing this section of the roadway. Of the remaining 12 piezometers, some indicated an unusually high rate of pore pressure dissipation. This could have been due to high permeability of the soil or malfunctioning of the piezometers. Hence, out of the remaining 12 piezometers 5 showing the highest accumulative pore pressures were selected, one from each group.

The accumulative pore pressures were determined by adding the maximum pore pressure at the end of each loading increment to the pore pressure increment dissipated during the no loading period.

Water Wells

For observing fluctuation of the ground water table, two 6 inch diameter galvanized pipes were installed at Parish Lane stations 12+10 and 15+60. These were installed about 10 feet away from the toe to minimize the influence of the embankment loadings on the neutral pressures.

Loading Procedure

The main factors that influence the pore pressure build-up in a foundation are (1) the type of fill material, (2) rate of compaction, (3) degree of compaction, and (4) the permeability of the subsoils. In this experiment A-1-b and A-2-4 soils were generally used for the embankment fill. The fill was constructed in accordance with Section 206 "Embankment and Backfill" of the Standard Specifications of the Utah Department of Highways. Each 12 inch lift was compacted to at least 90 percent of the optimum density. An average density of 125 lb/cu. ft. was obtained for the entire test area. Sand cone (64) and nuclear (56) density methods were used in checking the compaction. The embankments were constructed as rapidly as possible to minimize pore pressure dissipation during construction.

In Place Vane Shear Tests

This test is useful in obtaining the insitu shear strength values of foundation soils consisting of soft clays, silty clays, and clayey silts (63). The test gives the insitu shear strength values under the existing overburden pressures. In general, the unit measures the torque required to cause the soil to fail in a cylindrical surface without changing soil volume or structure (15). In this study, vane shear tests were performed prior to embankment loading and at various stages of subsoil consolidation after the embankment was placed.

Vane Shear Apparatus

The Acker vane shear test apparatus was used in this study. An assembly of the apparatus is shown in Figure 5. The apparatus is designed to fit standard soil drilling equipment. As shown in the diagram, the unit consists of a geared torque head which bolts directly to the top of the casing pipe with an adapter "hole collar". The torque-arm is bolted to the top of the drill rod which supports the vane. The ball point of the torque arm is pressed against the force recording gauge through a system of gearing with a 720 to 1 ratio meaning that one complete rotation of the crank handle rotates the vane 1/2 degree. The shearing force on the soil tested is applied through the force arm which in turn applies the force on the proving ring, on the lever arm, and on the rod holding the vane.

The torque arm is designed with 6, 12, and 18 inch lever arm positions which are used correspondingly for either soft, medium, or hard material.

The force gauge is of the maximum reading type in which the main hand forces the maximum reading hand to move forward until the soil begins to fail. At this point, the main hand begins to drop but the maximum reading hand remains stationary.

The vane rod stem consists of Standard A drill rods in 5-foot sections with ball bearing guide couplings at every 25 feet. The bearings are

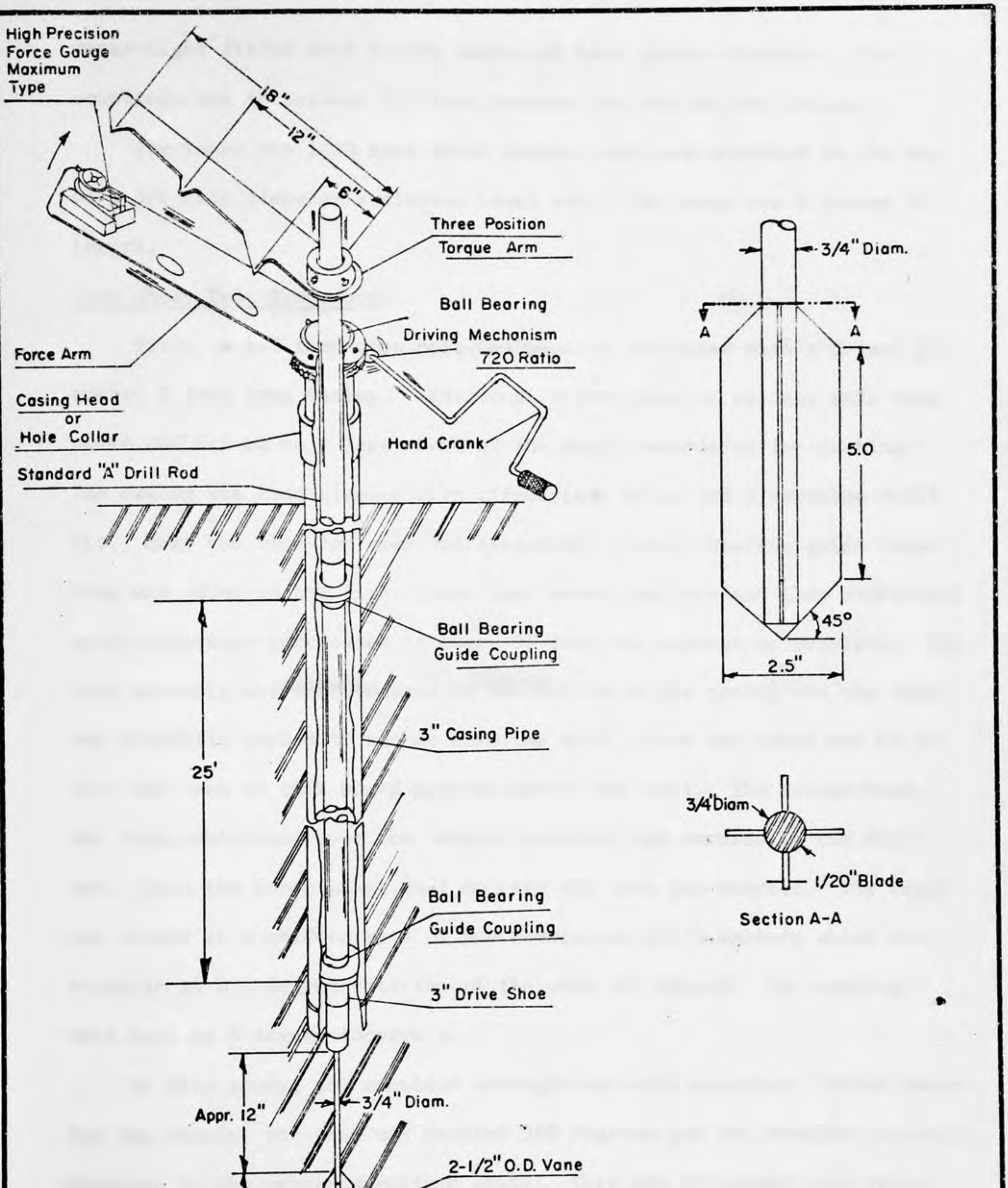


Figure 5 VANE TEST APPARATUS

water-tight fitted with O-ring seals and have grease chambers. The couplings are to prevent friction between the rod and the casing.

The vanes are 1/20 inch thick blades which are attached to the end of a 3/4 inch diameter stainless steel rod. The vanes are 5 inches in length.

Vane Shear Test Procedure

First, a 4-5 foot deep hole was augered and cased with a 3 inch diameter 5 foot long casing. Additional 5 foot section casings were then added and driven to 2 feet short of the depth considered for testing. The casing was then cleaned with circulatory water and a rotating drill bit. Next the vane-rod stem was assembled. A ball bearing guide coupling was added to the first joint just above the vane and then additional guide couplings were added at every 25 foot rod section as required. The vane assembly was next lowered to the bottom of the casing and the vane was carefully pushed 18 inches into the soil. Care was taken not to rotate the vane as this would have disturbed the soil. The torque head was then positioned over the adapter coupling and secured to the drill rod. With the force gauge dial on zero the test was started. The crank was turned at a uniform rate of one revolution per 5 seconds which corresponds to 0.1 degree rotation of the vane per second. The readings were made at 5 degree intervals.

In this study, the remolded strength was also measured. After shearing the sample, the vane was rotated 360 degrees and the remolded strength measured in the manner described above. This was to measure the sensitivity of the soil.

LABORATORY APPARATUS AND TESTING

Triaxial, unconfined compression, and pore pressure apparatus were used in laboratory shear strength measurements. X-ray diffraction, chemical, and AASHO soil classification tests were used in identifying the soils tested. The details of the apparatus and the tests are presented below.

Triaxial Apparatus

A Karol-Warner Model 500 triaxial test apparatus was used in this study. The principal features of the apparatus are illustrated in Figure 6. Shown in the diagram is a translucent cylinder, 6" O.D. x 5 1/2" I.D. x 7" in length, containing a test specimen sealed in a rubber membrane. The test specimen is confined on both ends with porous discs which are mounted in plastic caps. A small bore in the center of the bottom cap, about 1 mm in diameter, connects the base of the sample to the null indicator of the pore pressure apparatus. The major principal stress on the sample is applied, at a constant strain rate, through a ram bearing against the top cap. Details of apparatus are given by Bishop and Henkell (4).

Pore Pressure Apparatus

The pore pressures were measured with a Farnel (Model 351) unit. A schematic diagram of the unit is given in Figure 6. The original model had nylon tube leads which expanded under pressure and developed a considerable amount of time lag in pore pressure measurements. The problem was eliminated by replacing the nylon tubes with copper tubes. The original fittings were also made of nylon which were replaced with brass.

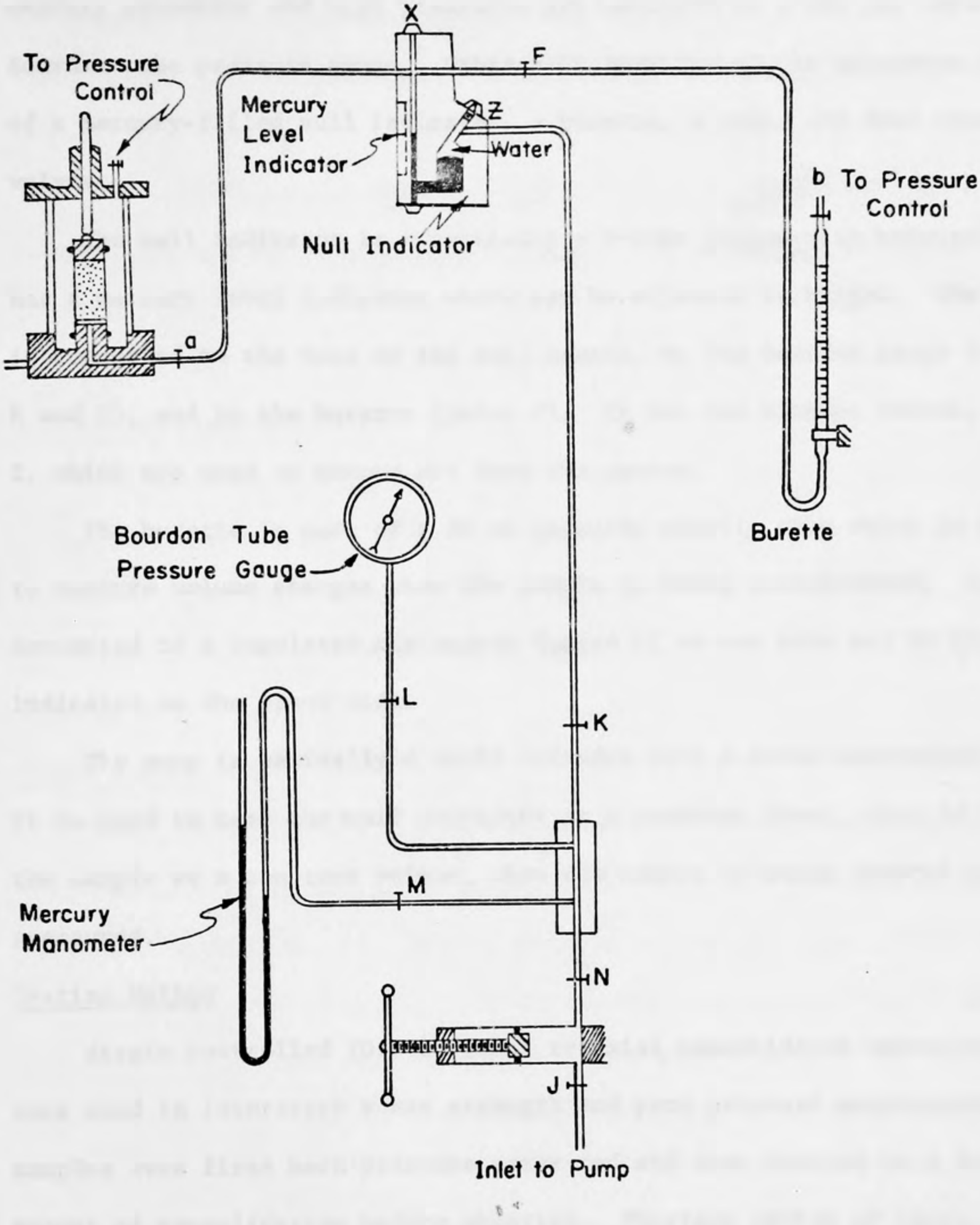


Figure 6 Layout of Pore Pressure and Triaxial Apparatus

The apparatus is designed to measure pore pressures without any flow of water to or from the sample. Low pore pressures are measured on a mercury manometer and high pressures are measured on a 200 psi capacity Bourdon tube pressure gauge. Other main features of the apparatus consist of a mercury-filled null indicator, a burette, a pump, and four connection valves.

The null indicator is essentially a U-tube filled with mercury. It has a mercury level indicator which can be adjusted in height. The unit is connected to the base of the soil sample, to the Bourdon gauge (valves K and L), and to the burette (valve F). It has two bleeder valves, X and Z, which are used to remove air from the system.

The burette is made of a 30 ml capacity plactic tube which is used to measure volume changes when the sample is being consolidated. It is connected to a regulated air supply (valve b) on one side and to the null indicator on the other side.

The pump is basically a small cylinder with a screw controlled piston. It is used to keep the null indicator at a constant level, that is to keep the sample at a constant volume, when the sample is being sheared or back-pressured.

Testing Method

Strain controlled (0.002"/min.) triaxial consolidated undrained tests were used in laboratory shear strength and pore pressure measurements. The samples were first back-pressure saturated and then drained to a desired amount of consolidation before shearing. Thirteen series of tests, four tests in each series, were conducted for this study. One sample in each series was allowed to consolidate to 90-100 percent of the primary consolidation under the insitu effective pressures. The remaining three samples were consolidated under a load equivalent to effective induced embankment loading. These samples were sheared at various stages of consolidation. All samples were initially back pressured to assure complete saturation.

The testing required a careful preparation of the pore pressure apparatus and the specimen tested. A detailed description of machine preparation, sample preparation, and testing procedure is given in Appendix III. Test resultsare given in Appendix IV.

Unconfined Compression Apparatus

The unconfined compression tests were run on a Karol-Warner (KW550) unconfined compression machine. The machine was equipped with a Soil Test double proving ring (PR-3) with a high range capacity of 300 lbs. and low range capacity of 100 lbs. The tests were run at a constant strain rate of 0.05"/min.

X-Ray Diffraction

X-Ray Diffraction along with soil chemical analysis was used for soil identification in this study. The x-ray method is based on the Bragg law which states that $n\lambda = 2d\sin\theta$ where n is a whole number, λ is the wave length of the x-rays used, d the interplaner spacings (A°), and θ the angle between the incident beam and the atomic plane. The d-spacings thus obtained are used for mineral identification as it is a constant for a particular mineral.

A General Electric XRD-5 diffractometer, using radiation from a copper tube with a nickel filter, was used in obtaining the x-ray diffractometers. Typical examples of the x-ray diffractometers are given on pages 24 and 25 as Figures 3 and 4. The major constituents of the samples tested are given in Table 2, page 23.

Soil Chemical Analysis

Quantitative chemical analysis was performed on representative soil samples recovered from the test area. The results of these tests are presented in Table 2, page 23. In addition, the soluble salt content of the pore water extracted from soil samples taken at various stages of embankment consolidation was also determined. This was to observe the changes in soil water salt content due to transient flow caused by consolidation pressures. No noticeable change of the salt content was observed.

Other Tests

Other major laboratory tests performed for supplementary data included: Consolidation, AASHO Soil Classification, Atterburg Limits, Specific Gravity, Soil Density, and Natural Moisture. For testing methods reference is made to "Soil Testing for Engineers" by N.T. Lambe (1967), and "Standard Specifications" for Highway Materials by the American Association of State Highway Officials. The results of these tests are presented as Appendix I.

NUMERICAL TECHNIQUES

The principal stresses $\Delta\sigma_1$ and $\Delta\sigma_3$ used in predicting pore pressures were determined using the plane strain finite element (60) and elastic theory (21) methods of stress analysis. These stresses are compared with those obtained with Boussinesq's method. Subsequently, the basic features of these methods are briefly described.

Finite Element Method

The finite element method of stress analysis has been described by Wilson (60) and Clough (8) and used in many soil mechanics problems (8, 11, 12, 57). The method assumes a two dimensional elastic structure with the soil mass being divided into a finite number of elements connected at their nodal points. The method assumes a linear "plane" stress strain relationship within each element. That is, lines initially straight remain straight in their displaced position. On the bases of these assumptions the stiffness properties of each element, that is the nodal stress-strain relationship, is calculated. Thus, with the displacements of all nodal points known the stresses at these points are determined. In this study the mass to be studied was divided into a series of triangular plate elements as illustrated in Figure 7.

Elastic Theory Method

The elastic method of stress analysis provides equations with which the principal stresses beneath an embankment can be determined. The method assumes the applied pressure to be a uniform surface load proportional to the height of the embankment. The method assumes elastic, homogeneous, and isotropic subsoil conditions. The stress-strain

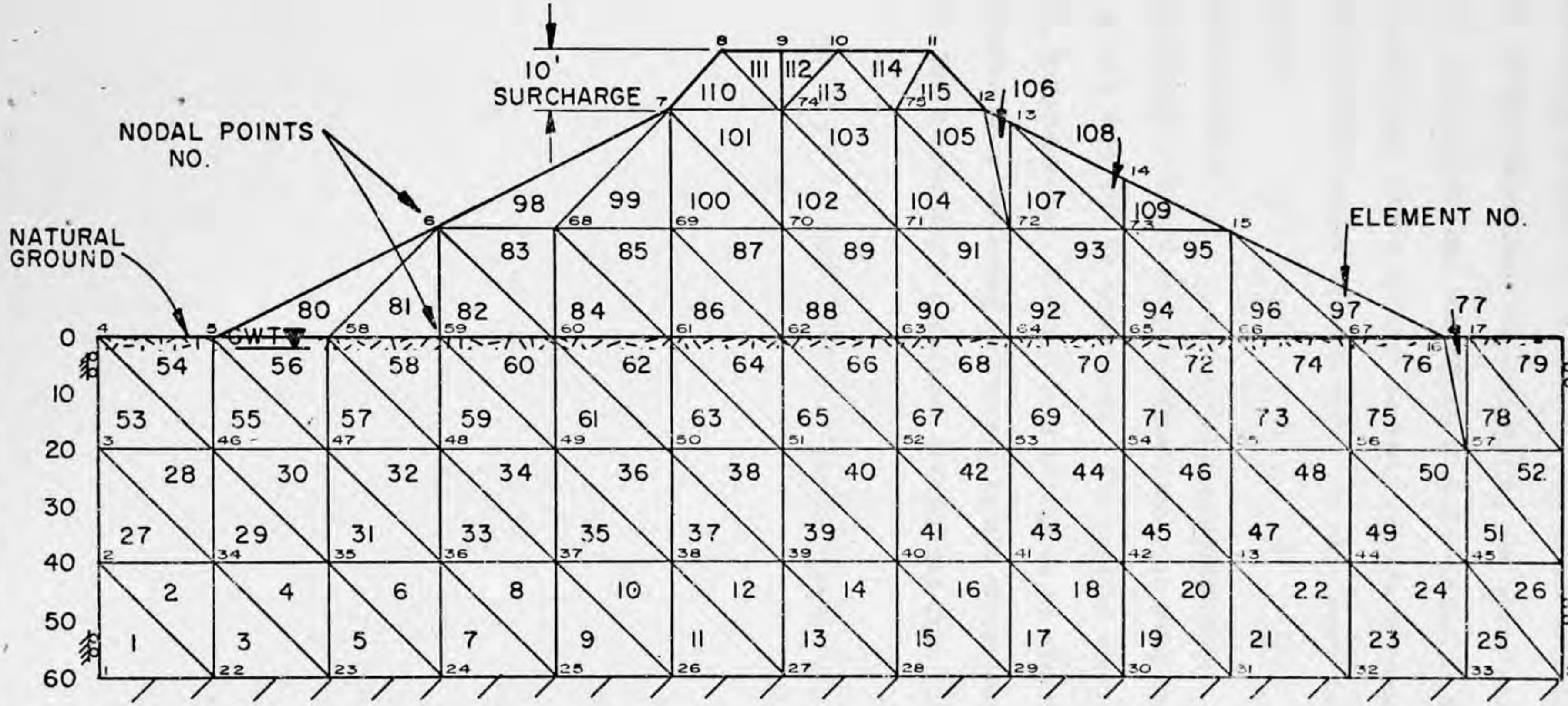


FIG. 7 FINITE ELEMENT REPRESENTATION OF EMBANKMENT LOADING

relationship is assumed to be linear. One needs only the density and the geometry of the embankment for calculating the principal stresses.

Both the elastic and the finite element method of stress analysis, in particular the finite element method, require numerous calculations. One needs to have access to computers. In this study both methods were computerized.

Boussinesq's Method

Boussinesq's method provides equations with which the stress components within a soil mass can be determined. The applied force is assumed to be a single, perpendicular, surface load acting on an elastic, homogeneous, and isotropic mass extending infinitely in all directions from a level surface. The Boussenesq's equations are derived from Elastic Theory.

DISCUSSION AND ANALYSIS OF RESULTS

This section is primarily concerned with the analysis of predicted and measured pore pressures, rate of pore pressure gain due to embankment loading, rate and amount of shear strength gain due to consolidation, and the percentage of shear strength gain at various stages of soil consolidation. The equation used in predicting pore pressures, the methods used in calculating the stresses, the anisotropy of the pore pressure parameter A with depth, and the reliability of the piezometers used are also somewhat examined.

Predicted and Measured Pore Pressures

The computed and field measured pore pressures are shown in Table 3. As shown in the table the agreement between the measured and the computed pore pressures, using stresses determined by the finite element method, is surprisingly close. With the exception of piezometer 16 the remaining 4 piezometers show exceptionally close correlation. The following explanation is offered for piezometer 16. A triaxial test was not available in the immediate piezometer area and the factor A = 0.5 chosen for estimating the pore pressure was selected from test 1 (page 143) for which the sample was taken about 10 feet above the piezometer 16 location. These areas may not have had the same soil properties. The problem may also lie in functioning of the piezometer; its recordings were consistently higher than the other piezometers throughout the test period.

The computed pore pressures, using the elastic theory method of stress analysis, did not agree with the measured pore pressures. Piezometers 7, 10, 13, and 22 shown in Table 3 all indicated considerably lower pore pressures. Piezometer 16 indicated a higher pore pressure.

One cannot draw a definite conclusion from this study alone as to the accuracy of either method of pore pressure prediction. Some studies (23) have indicated that the elastic theory method is as reliable in predicting pore pressures. However, based on the analysis presented below it appears that the estimates based on the finite element method are closer to actual field conditions. Subsequently the method used in predicting the pore pressures and the methods used in calculating the stresses are examined to possibly explain some of the anomalies inherent in the system and to point out the basis of the conclusion just drawn. At this point

TABLE 3. COMPARISON OF MEASURED AND COMPUTED PORE PRESSURES

Piezometer			Embankment Height, Ft.	Measured Pore Pressure PSI	Predicted Pore Pressure, PSI		A-Factor Used	AASHO
No.	Sta.	Depth, In.			Finite Element Method	Elastic Theory Method		
7	12+10	20	34.5	10.2	11.3	15.4	0	A-7-6(13)
10	14+10	19	44	11.6	10.2	16.3	-0.3	A-6(9)
13	15+60	22	47	18.5	20.4	28.8	0.6	A-6(10)
16	16+90	29	52.5	29.0	19.4	27.3	0.5	A-7-6(11)
22	22+30	25	30	16.5	15.9	22.0	0.8	A-6(9)

one may state that the precision employed in pore pressure estimation is no better than the precision with which the incremental stresses and the pore pressure parameters are obtained; and the precision used in field pore pressure measurements is no better than the reliability of the piezometers used. The reliability of the piezometers used is well proven but the reliability of the equation used in predicting the pore pressures and methods used in determining the stresses requires further investigation.

Skempton's Equation - The equation $\Delta_u = B\Delta\sigma_3 + AB\left(\Delta\sigma_1 - \Delta\sigma_3\right)$ used in predicting pore pressures does not allow for pore pressure dissipation during embankment construction. It assumes instantaneous loading or impervious soil conditions. As experienced in this study and in a study conducted earlier (1) this is not always the case. Embankments are commonly constructed in stages and there is a dissipation of pore pressure during construction. The dissipation of pore pressure during construction is shown in Figures 17 through 28 in Appendix II, pages 95-106 by comparing the existing and the accumulative pore pressures. The accumulative pore pressures are generally higher. If one were to disregard the dissipated pore pressures the predicted pore pressures would have been considerably higher. In other words, working strictly with predicted pore pressures, which is the common case in practice, and not allowing for dissipation or pore pressures during construction, could lead to over-estimation in design and an increase in cost of construction.

Stress Calculations - The stresses calculated below the center of a 50 foot high 36 foot wide embankment (Fig. 7), using the finite element and elastic theory methods, along with the vertical stresses calculated by Boussenesq's method are tabulated below for comparison purposes.

Table 4 - Comparison of Stresses by the Solution of Elastic Theory, Finite Element, and Boussenesq Methods

Depth Below Ground Surface	Elastic Theory		Finite Element		Boussenesq
	$\Delta\sigma_1$	$\Delta\sigma_3$	$\Delta\sigma_1$	$\Delta\sigma_3$	$\Delta\sigma_1$
10	39.2	27.6	27.5	15.6	42.7
20	37.9	21.4	27.0	14.6	40.6
30	36.9	16.4	36.9	11.7	37.7
40	34.7	12.6	26.8	8.9	35.6
50	33.1	9.8	26.7	5.9	33.1
60	--	--	26.5	2.9	30.6

As indicated in the table the stresses calculated by the elastic theory method are in close agreement with the stresses obtained by Boussenesq's solution but they are considerably higher than the stresses calculated by the finite element method. Experience with soils in this area has indicated that Boussenesq's method generally results in an over-estimation of stresses, and because the elastic theory method results in similar stresses, it must also be conservative. Predicted embankment settlements in this area using Boussenesq's method have been generally higher than the actual field measured settlements. Hence, it appears that a designer is being overly conservative in using either method. In general, the finite element method of stress analysis appears to give a better picture of the stresses because of its consideration of the actual soil properties, e.g., Poissons ratio, modulus of elasticity, unit weight, non-homogeneity of the soils, and lastly its consideration of the individual lifts in an embankment rather than the entire embankment as a surface load. Further, the pore pressure estimates, using stresses determine by the finite element method are in close agreement with the field measured pore pressures.

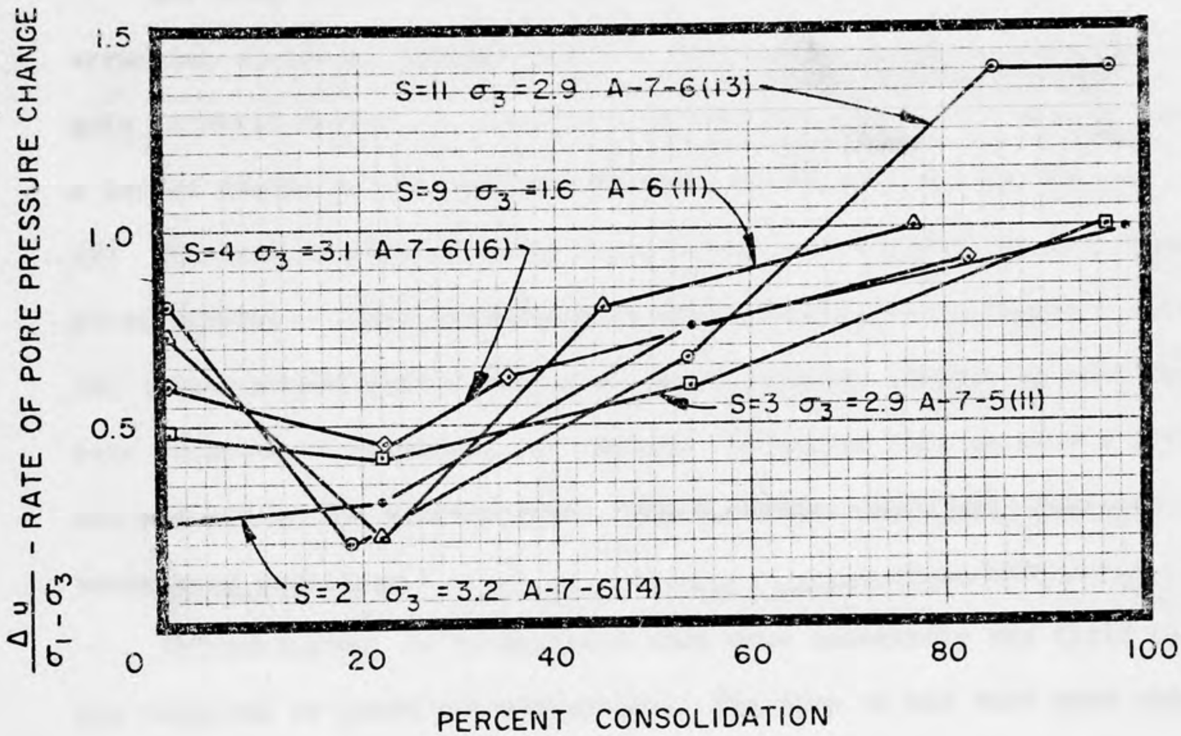
The most obvious drawback of the elastic theory method is its lack of consideration of subsoil properties and its assumptions of soil properties which seldom occur in nature. Usually soils, in particular soils encountered in this area, are seldom completely elastic, homogeneous, or isotropic as assumed in the method. The soils in this area (Fig. 1) are often varved and anisotropic. Also, embankments are usually constructed in increments (or lifts) which means that the effects of every lift on a point beneath the embankment will not be the same as assumed in the method. The lower lifts usually induce higher pressures. One could consider the individual lifts but it would require numerous calculations. Finally, the validity of linear stress-strain relationship is also questioned on the basis that most clays behave somewhat plastically as well as elastically. The extent of influence of these assumptions is not known but it is believed that the predicted pore pressures are conservative. Some investigators, including Lambe (23) and Taylor (55), are skeptical about the use of the elastic theory in soil mechanics. Taylor, for example, believes that the use of elastic theory, other than in vertical stress determination, is questionable.

Pore Pressure Parameter A - Selection of a proper A value is also important in pore pressure predictions. The A value is not constant for a particular soil but is a function of the strain as shown in Figure 29 through 41,

Appendix IV. Since the objective of this study was to obtain the pore pressures soon after embankment loading, the A-value was selected at maximum deviator stress. The A values thus obtained are shown in Table 6, page 75.

Rate of Pore Pressure Gain

Experiments by the author (1), Bishop (2), and Li (27) have indicated that after a period of construction shutdown the rate of pore pressure increase with increasing stresses $(\frac{\Delta u}{\Delta\sigma_1 - \Delta\sigma_3})$ is less than the increase prior to construction shutdown. The phenomenon was difficult to observe in this study because of the fast loading rate used in constructing the embankment. Sufficient consolidation time was not allowed between two consecutive loadings. Also, the pore pressure dissipation rate was high, especially for higher embankment loadings, which made accurate observations of pore pressure changes difficult. The laboratory tests on the other hand clearly illustrate the phenomenon. These tests were set to duplicate field conditions. First the samples were consolidated to a desired degree and then sheared while observing the pore pressure changes. Figure 8 shows the results of these tests for different consolidation pressures. As shown in the figure the rate of pore pressure gain is sharply decreased with increased soil consolidation. This was the general case for samples sheared at 0 to 25 percent consolidation. For soils exceeding 25 percent consolidation the situation is reversed, the rate of pore pressure gain is gradually increased. Between 80-100 percent soil consolidation nearly all of the applied stresses are transferred to the pore water. The laboratory tests were conducted under different conditions which may not duplicate field conditions. Laboratory tests were conducted under a confined condition allowing no drainage during shearing. In the field the pore pressure was continuously dissipated as the embankment was placed. Hence, there are some doubts whether the two situations can be compared. It would have been a more realistic comparison if the laboratory tests were



KEY

σ_3 = Consolidation Pressure, TSF
S = Sensitivity
A-6-11 AASHO Classification

FIG. 8 EFFECT OF CONSOLIDATION ON RATE OF PORE PRESSURE CHANGE also allowed to drain while being sheared. A possible cause for the drop in the rate of pore pressure gain might be the decrease in soil volume as the sample is being sheared. All samples showing a decrease in the rate of pore pressure gain indicated a decrease in soil volume.

The drop in the rate of pore pressure gain, after a period of construction shutdown, appears possible for the following reasons: (1) Soils gain strength during the construction shutdown period and when reloaded a lesser amount of the applied stresses are transferred to the pore water. (2) The rate of pore pressure dissipation is increased due to higher applied stresses. This phenomenon is well illustrated in Figure 9 where for larger consolidation pressures the C_V-values, indicating that rate of pore pressure dissipation, are larger. Of course this is only a possibility and may not be the general case. The C_V-values could well decrease with increasing pressures.

In conclusion, it is believed that more laboratory and field tests are required to prove the phenomenon. The drop in the rate pore pressure after a period of soil consolidation appears possible. If adequately proven it could be very advantageous in highway or earth dam construction where embankment loading rate is always a problem. It would mean that after a construction shutdown and a period of pore pressure dissipation the embankments can be reloaded at a faster rate.

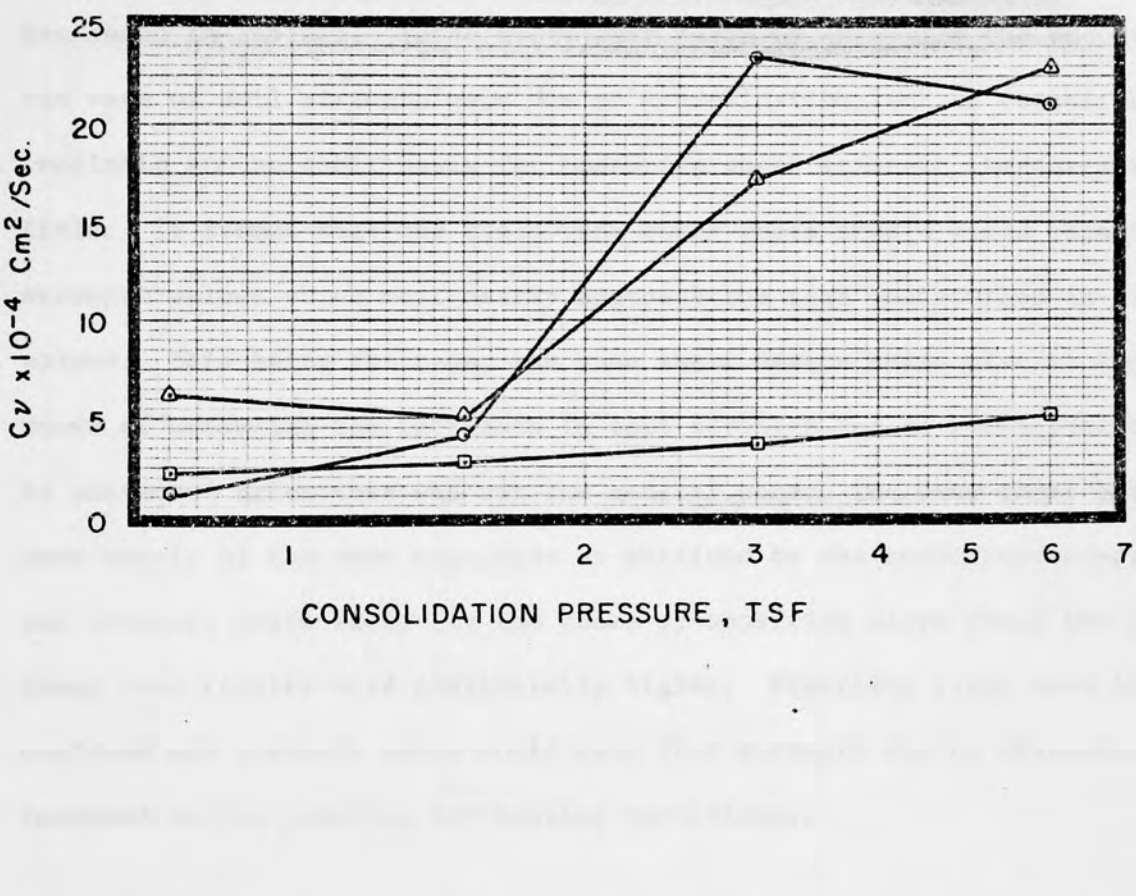


FIG. 9 EFFECT OF CONSOLIDATION PRESSURE ON COEFFICIENT OF CONSOLIDATION (C_ν)

Rate and Amount of Shear Strength Gain

Field in-place vane shear, unconfined compression and consolidated undrained triaxial test results are presented as Figures 10 and 12, pages 61 and 67. These are the shear strength measurements at various stages of subsoil consolidation for soils corresponding to piezometer elevations. The shear strength measurements in other areas along the boring depths are shown in Table 5. These tests were taken to determine the amount and the rate of soil strength gain due to consolidation, and to establish a realistic and suitable basis for measuring shear strength increases in the field. It seemed that the field vane shear tests should yield shearing strength values which most nearly approach the true undisturbed in-place values. This being the case, the vane shear device would also be a good means of measuring the increases in soil strength due to consolidation. As presented below this was not the general case. The vane shear values were nearly of the same magnitude as obtained by the unconfined compression and triaxial tests except in the cases of sensitive clays where the vane shear test results were considerably higher. Sensitive clays used in unconfined and triaxial tests could have lost strength due to disturbances received during sampling and testing operations.

Comparison of Vane Shear and Unconfined Compression Test Results - Discussed in this section are the vane shear and the unconfined compression test results for soils at different depths of exploration. The triaxial tests were limited to piezometer areas only and they are included in the next section.

The results of the unconfined compression and the vane tests, at various stages of subsoil consolidation, are shown in Table 5. As shown

Table 5. Comparison of shear strength (S_u) measurements as determined by unconfined compression and field vane tests prior to embankment loading and at various stages of foundation consolidation.

Sample Location		S_u Before Embk. Loading, TSF			S_u After Embk. Loading, TSF					
Station	Depth	Vane	Unconf.	AASHO	Vane	Unconf.	AASHO	Vane	Unconf.	AASHO
					70% Consolidation			80% Consolidation		
12+10	10	-	-	A-7-6(13)	1.49	0.90		1.54	-	
	15	-	-		1.10	-		0.68	0.54	A-7-6(13)
	20	0.76	0.47	A-7-6(13)	0.64	0.99	A-7-6(16)	0.90	0.59	A-7-6(13)
	25	-	-		0.51	0.71	A-6(10)	0.59	0.81	A-6(8)
	30	-	-		1.51	1.12		1.40	0.90	A-6(10)
	35	0.67	0.58		-	0.21		-	0.70	
					60% Consolidation			75% Consolidation		
14+10	5	-	-		-	0.15	A-6(12)	-	-	
	10	-	-		0.99	0.36	A-6(8)	1.37	.49	A-6(11)
	15	0.70	0.70		1.01	0.14	A-6(12)	0.90	.48	A-6(11)
	20	1.09	0.65		0.54				0.59	A-7-6(13)
	25	0.59	0.76	A-6(9)	1.01			0.58	0.77	
	30	0.13	0.30		0.43			0.45	0.90	A-7-6(15)
	35	1.20	0.60	A-7-6(12)	0.50			0.72	0.77	
	40		0.60							
	45	1.01								
					70% Consolidation			80% Consolidation		
15+60	5	-	-		1.36	0.70	A-7-6(14)	1.63	0.44	
	10	-	-		0.70	-		-	0.81	
	15	0.65	0.65	A-6(10)	0.93	0.30	A-7-6(12)	-	0.55	
	20	-	-		-	-		1.07	0.77	
	25	0.65	0.60	A-7-6(14)	0.62	-		0.68	-	
	30	0.47	0.43	A-7-6(20)	0.50	0.17	A-7-6(19)	0.45	-	
	35	0.81	0.60					0.65	0.80	

Sample Location		S_u Before Embk. Loading, TSF			S_u After Embk. Loading, TSF					
Station	Depth	Vane	Unconf.	AASHO	Vane	Unconf.	AASHO	Vane	Unconf.	AASHO
					31% Consolidation			70% Consolidation		
16+53	5	-	-		1.10	-		1.47	-	
	10	0.87	0.60		1.20	0.69	A-6(10)	0.69	0.27	A-7-6(11)
	15	1.31	0.65		0.23	0.64	A-6(12)	.62	0.55	
	20	0.44	0.22	A-7-6(10)	0.81	0.55	A-7-6(11)	0.72	0.55	A-7-6(12)
	25	0.58	0.50	A-7-5(11)	0.44	0.72	A-6(8)	1.36	1.15	A-7-6
	30	0.20	0.44	A-6(9)	1.58	0.63	A-6(12)	1.20	0.93	A-6(10)
	35	1.09	1.00		1.32					
22+30	5	-	-		1.01	0.24	A-6(11)	-	-	
	10	0.54	.56		1.07	-		0.62	0.60	
	15	-	-		-	.17		-	-	
	20	0.40	0.33		0.11	0.36		0.69	0.64	
	25	0.23	0.32	A-6(9)	0.39	0.50	A-6(8)	0.69	0.50	
	30	0.59	0.60		0.37	.48	A-7-6(13)	0.72	0.70	
	35	0.42	0.39		1.10	.45		1.36	1.15	

in the table the test values are in close agreement for tests taken prior to embankment placement. In general, the vane shear test results are slightly higher. The difference in the test values becomes more pronounced after the embankment is placed and the soils begin to consolidate. This seems to be particularly true for soft and sensitive clays with A-7-6(12) to A-7-6(20) AASHO classifications. In these soils the vane shear test yielded a higher strength than the unconfined compression tests. Relatively speaking, the vane shear tests indicated a larger and faster rate of strength gain as the soils became consolidated. The difference probably lies in the disturbance these soils received during sampling operations and testing preparations. In-place testing eliminates much of the problem. Also, when a sample is removed from its natural location the stresses applied by the overburden soils are released and the soil begins to expand. This also disturbs the soil.

From the results of this study it is concluded that the field vane apparatus provides a more reliable indication of the shear strength of soft and medium clays than the unconfined test. For these soils the vane shear test appears to be a better method of measuring the increases in soil strength due to consolidation. For other clays its advantage over conventional test methods is questionable.

Completed research in soft foundations has suggested that vane test measures the remaining shear strength, the shear strength beyond the shearing stresses already existing in the foundation, which is available for mobilizaton. Assuming no pore pressure dissipation during construction, this implies that the measured shear strength after embankment placement will be less than the strength measured prior to embankment placement.

This also suggests that the vane shear recording along an impending failure zone should be zero or negligible. From the results of this study it was difficult to establish the phenomenon as there was an active consolidation during construction. Soils gained strength while the embankment was being loaded. If there were any losses of soil strength due to strength mobilization they were compensated by the gains in strength due to consolidation. The mobilization of soil strength is possible but whether it can be measured by the vane shear apparatus was not revealed in this study. There were drops in soil shear strength (Fig. 13B), as discussed later, but whether it was due to mobilization or soil disturbance (remolding) is not known. The possibility that the vane shear would indicate a zero strength at a failure zone does not seem realistic unless the soil is assumed to be in a liquid state.

Comparison of Vane Shear, Unconfined Compression, and Triaxial Test Results - Figures 10 through 15 represent the results of these tests at various stages of subsoil consolidation. The tests were run on soil samples corresponding to piezometer elevations. In this section the results of these tests are combined with the piezometer recordings to measure the increases in soil strength due to consolidation. As discussed below, both the unconfined compression and the triaxial test results compare reasonably well with the vane test measurement but the agreement between the triaxial and the vane test results is better. The results of these tests for each piezometer location are discussed separately.

Figures 10A and 11A represent field vane, unconfined compression and consolidated undrained triaxial test results on soils corresponding to piezometer 7 location (Sta. 12+10). Piezometer 7 was placed approximately 20 feet below the natural ground surface where the material was classified as soft to medium gray silty clay. The soil had an average dry density of 92 lbs./cu. ft. with AASHO Classification of A-7-6(13), liquid limit of 44%, plastic limit of 23%, and moisture content of 31%. The soil had a sensitivity range of 4-5 which is considered very sensitive. The permeability of the soil was relatively high as evident from Figures 17 and 18 shown in Appendix II, pages 95-96. These figures show a rapid rate of pore pressure dissipation during construction. Most soil consolidation in the test area occurred during embankment loading.

As illustrated in Figure 10A a similar trend of increase in soil strength is measured by all three test methods but the measurements by the vane shear apparatus are consistantly higher at all levels of soil consolidation. Triaxial and the unconfined compression tests indicate nearly the same shear strength values up to about 40 percent consolidation but for consolidations exceeding 40 percent the triaxial tests indicate a higher increase in strength. The lower strength measured by the unconfined compression and the triaxial test methods are probably due to disturbances of the soil samples received during sampling and testing operations. The soils in this area are very sensitive. The triaxial test results show an eventual regain in strength (Fig. 10A) due to increased consolidation but the unconfined compression tests show comparatively little gain in strength. As shown in Figure 11A, the triaxial test results indicate about 80 percent increase in strength due to soil consolidation while the unconfined compression and the vane shear tests indicate about 40 percent increase in strength. It is interesting to note that the ultimate strength measured by the unconfined compression test, after a complete soil consolidation, never reached the initial strength value measured by the vane shear (Fig. 11A).

In summary, the results of this test indicate that for soft to medium, sensitive clays the vane shear apparatus yields a more reliable data than those obtained by the unconfined compression and the triaxial test methods.

Figures 10B and 11B represent field vane shear, unconfined compression, and consolidated undrained triaxial test results on soil samples corresponding to piezometer 10 location (Sta. 14+10). Piezometer 10 was placed approximately 19 feet below the natural ground surface. The soil in this area was visually classified as medium to stiff organic silty clay with seams of fine sand. The average dry density of the soil was 59 lbs./cu. ft., and the AASHO Classification was A-6(9). The soil had a liquid limit of 35%, plastic limit of 23%, and moisture content of 31%. The soil was considered very sensitive to slightly quick as its sensitivity range was 4 to 11. The soil consolidation rate was high as revealed by the pore pressure dissipation curves shown in Appendix II as Figures 19 and 20.

As shown in Figure 10B there is a fairly close agreement between the soil shear strength values as measured by the three test methods. This correlation is based on smooth curves drawn between the data points which were fairly scattered. One may question the validity of this approach but with the limited number of data available this appeared to be the most reasonable method. As shown in Figure 10B, the unconfined compression test results indicate a drop in the shear strength due to consolidation while the other two test methods indicate an increase in the soil strength. As in the previous case the drop in the shear strength is assumed to be due to disturbance the soil received during sampling and testing operations and release of the confining pressures when the soil was removed from its natural location. In particular the soil in this area was considered somewhat quick and could have easily lost its strength resulting from any disturbing elements. The triaxial and the vane shear tests indicated 50 percent increase in strength after complete consolidation (Fig. 11B).

Here again the vane shear apparatus proves to be a better device for measuring the shearing strength of sensitive clays. The triaxial test method yields a comparable result but the soil had to be initially back-pressure saturated and then completely consolidated under the in situ over-burden pressures.

Figures 10C and 11C represent field vane shear unconfined compression, and consolidated undrained triaxial test results on soil samples taken at piezometer 13 location (Sta. 15+60). Piezometer 13 was placed approximately 22 feet below the natural ground surface. The soil in this area was classified as soft to medium varved silty clay and had a liquid limit of 38%, plastic limit of 24%, and natural moisture of 30%. The average dry density of the samples tested was 72 lbs./cu. ft. The AASHO classification was A-6(10). The soil was relatively permeable as revealed by the embankment pore pressure dissipation curves presented as Figures 22,23, and 24 in Appendix II. It appears that the bulk of pore pressure was dissipated as soon as the embankment was placed.

As shown in Figure 10C a similar trend of shear strength gain was measured by all three test methods but the unconfined compression test values are consistently lower, by about 0.2 TSF, at all levels of soil consolidation. The vane shear and the triaxial test results are in close agreement at all levels of soil consolidation. The increase in soil shear strength, due to consolidation, was 40 percent as measured by the unconfined compression test method compared to 80 percent as measured by the triaxial and vane shear test methods. This is graphically illustrated in Figure 11C.

In conclusion, it appears that the vane shear and the consolidated undrained triaxial tests yield comparable shear strength values for soft to medium clays. The unconfined compression yielded about 75 percent of the shear strength values obtained by the triaxial and the vane shear tests.

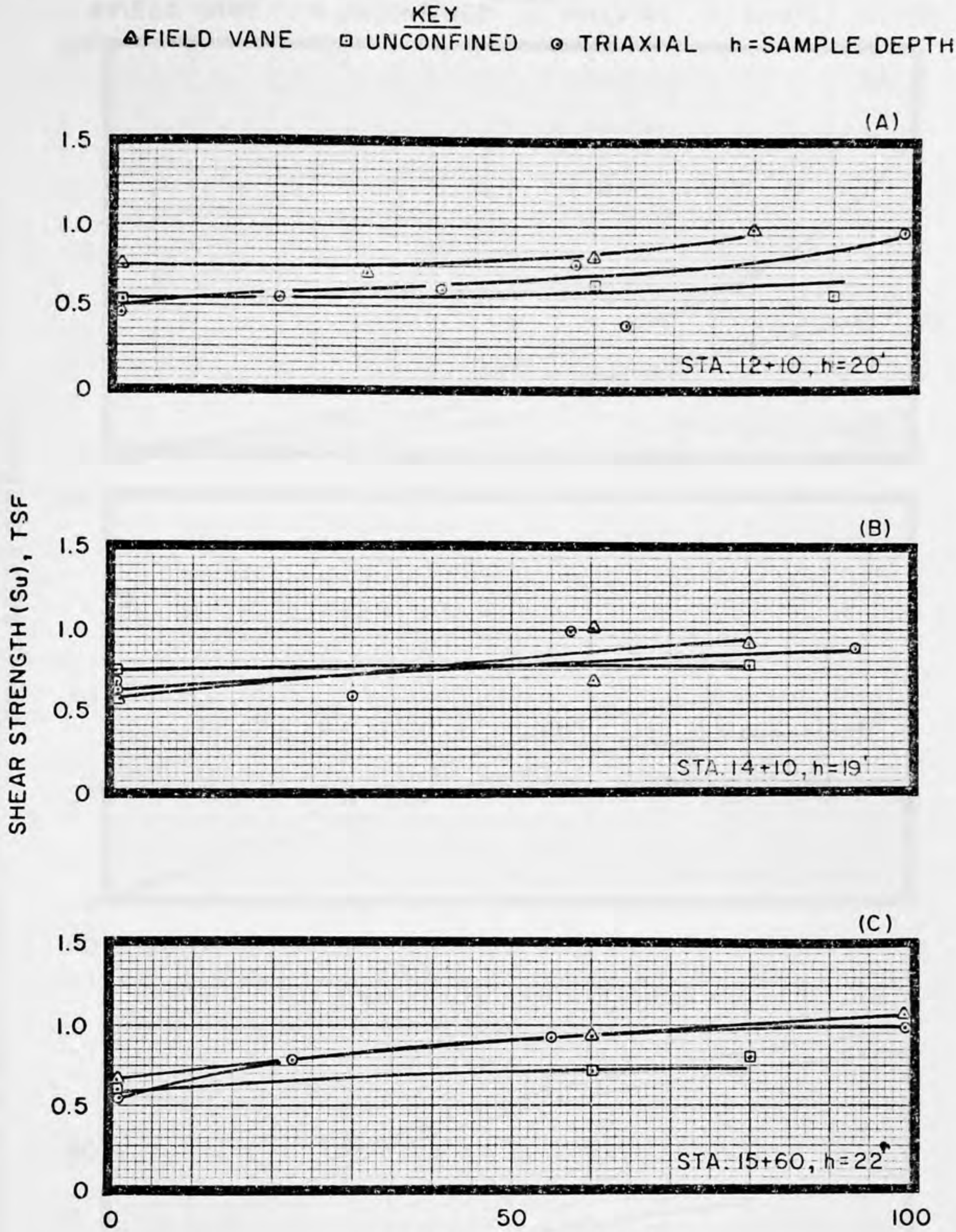


FIG. 10 COMPARISON OF SHEAR STRENGTH (SU) AS MEASURED WITH UNCONFINED, TRIAXIAL, AND FIELD VANE TESTS AT VARIOUS STAGES OF FOUNDATION CONSOLIDATION

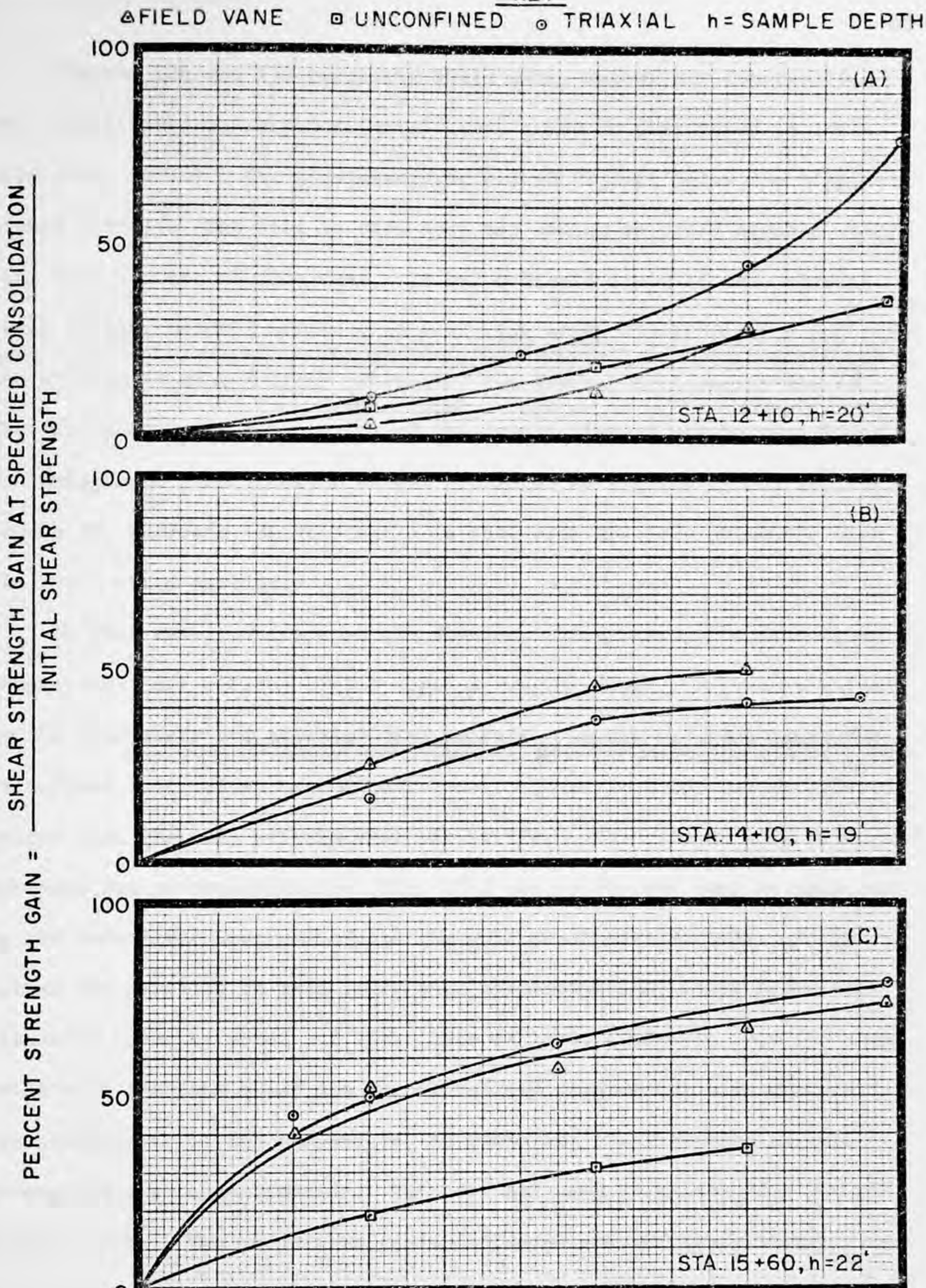


FIG. II COMPARISON OF SHEAR STRENGTH GAIN DUE TO CONSOLIDATION AS MEASURED BY TRIAXIAL, UNCONFINED, AND FIELD VANE TESTS

Figures 12A and 13A represent field vane, unconfined compression, and consolidated undrained triaxial tests taken at piezometer 16 location (Sta. 16+90). The piezometer was placed 29 feet below the original ground surface. The soil in this area was medium to stiff organic silty clay with a trace of fine sand. It had a liquid limit of 46%, plastic limit of 24%, natural moisture of 44%. The AASHO Classification indicated the soil to be an A-7-6(11) material. The average dry density was 75 lbs./ct. foot. The sensitivity of the samples tested was between 3 and 5. Embankment pore pressure curves presented as Figures 25 and 26, Appendix II, indicate that the soils in this area are less permeable than the three cited earlier.

In this case, contrary to the previous three cases, the unconfined compression test yielded higher shear strength values than those obtained by the vane shear and triaxial test methods. In the previous cases the unconfined test values were always lower. No explanation can be offered except that the soil in this area was stiffer. The rate of soil strength increase due to consolidation (Fig. 12A) was nearly the same as measured by the unconfined compression and the vane shear test methods. Their curves are parallel to each other with the unconfined values being consistantly lower by about 0.2 TSF. This at least indicates that for some soils both the vane shear and the unconfined compression test methods are consistant, if not comparable, in measuring the increases in soil strength due to consolidation. This did not seem to be the case for the earlier tests. The unconfined tests indicated comparatively little gain in strength. The triaxial and the vane shear test results were nearly the same for soil samples exceeding 40 percent consolidation.

Figure 13A illustrates the amount of increase in soil strength due to consolidation as measured by the unconfined compression, field vane, and triaxial test methods. In general, there is little correlation between the three test methods except at the initial stages of soil consolidation where the unconfined compression and the triaxial test values are in good agreement. For example, at 40 percent consolidation the unconfined compression and the triaxial test methods indicate only 50 percent increase in strength while the vane shear test method indicates 120 percent increase in strength. At 70 percent consolidation the respective values are 110, 60, and 160 percent.

In summary, it is concluded that for medium to stiff clays the unconfined compression test is as reliable as the vane shear and the triaxial tests in measuring soil strength properties.

Figures 12B and 13B represent the results of vane shear, unconfined compression and consolidated undrained triaxial tests on soil samples corresponding to piezometer 22 location (Sta. 22+30). Piezometer 22 was placed approximately 25 feet below the natural ground surface. The soil in this area was classified as soft, varved, organic silty clay. The samples tested had AASHO classification of A-6(9), A-6(11), and A-7-6(9). Their liquid limit, plastic limit, and natural moisture content range was 33-42%, 16-29%, and 40-46%, respectively. The average dry density was 80 lbs./cu. ft. The soil was relatively impervious as revealed by the embankment pore pressure curves presented in Appendix II as Figures 27 and 28.

As shown in Figure 12B there is a close correlation between the vane shear and the unconfined test results. The unconfined tests values are slightly higher at all levels of soil consolidation. Both methods indicate a sharp increase in soil strength due to consolidation. On the other hand, the triaxial test results are far below the unconfined compression and vane shear values. Initially there is a good correlation between the three methods but as soil consolidation increases the triaxial tests show a lower strength. The triaxial tests indicate a drop in soil strength during the initial stages of soil consolidation. As consolidation proceeds, the soil begins to gain strength but at a much slower rate than those indicated by the unconfined and vane shear test methods. For example, at 60 percent consolidation (Fig. 13B) the triaxial test indicates only a 16 percent strength gain as compared to 116 to 180 percent gains measured by the unconfined and the vane shear test methods respectively. No explanation can be given. In the previous cases the loss in strength was attributed to the disturbances the soil samples receive during sampling and testing operations. If this was the case, the unconfined tests would also show a similar drop in strength. However, this is not the case as shown in Figures 12B and 13B. It is possible that the soil samples used for the triaxial tests had different properties than those used for the unconfined tests.

The results indicate that for soft clays the vane shear test is as reliable as the unconfined compression test in measuring soil strength properties.

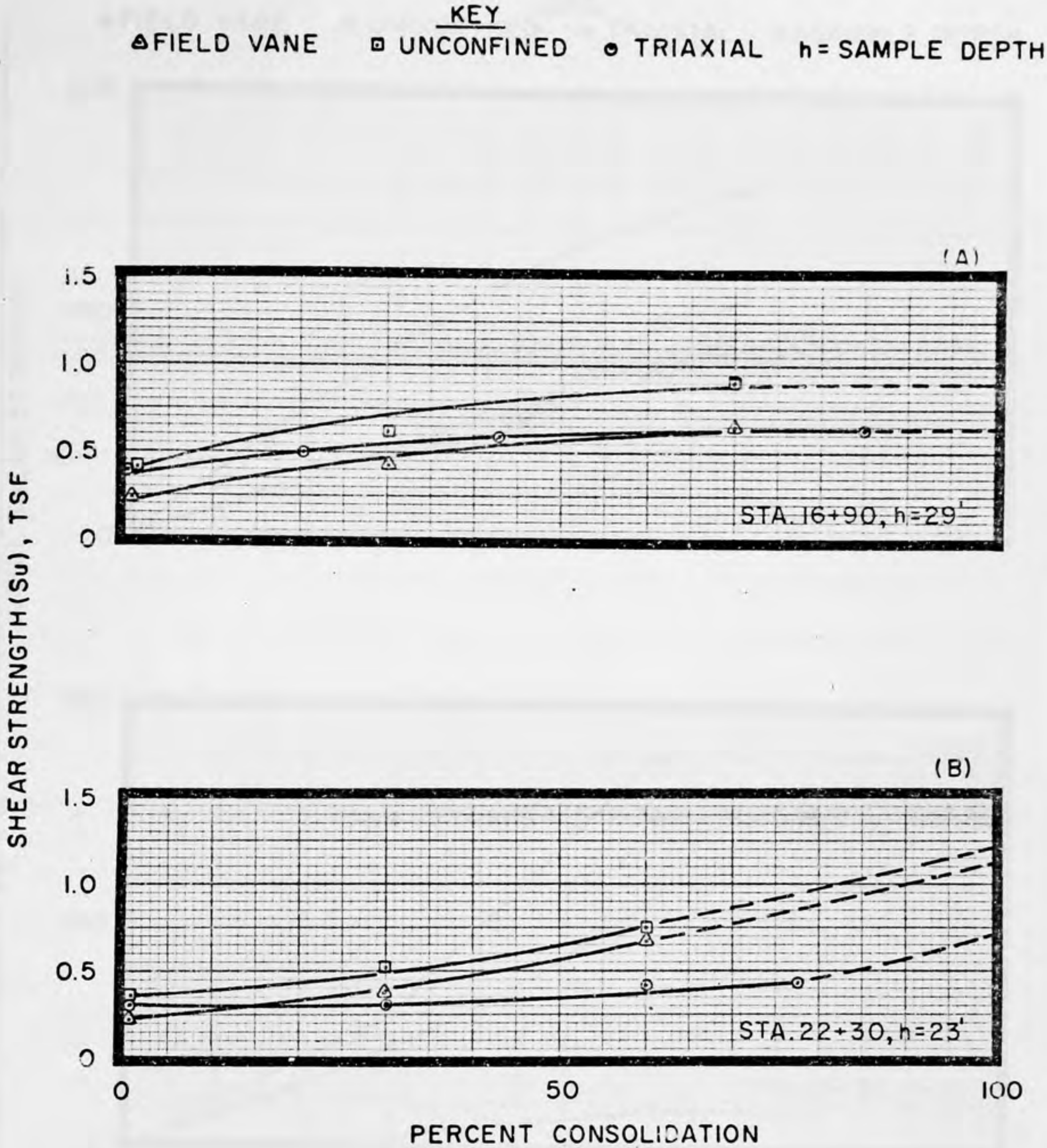


FIG. 12 COMPARISON OF SHEAR STRENGTH (SU) AS MEASURED WITH UNCONFINED, TRIAXIAL, AND FIELD VANE TESTS AT VARIOUS STAGES OF FOUNDATION CONSOLIDATION

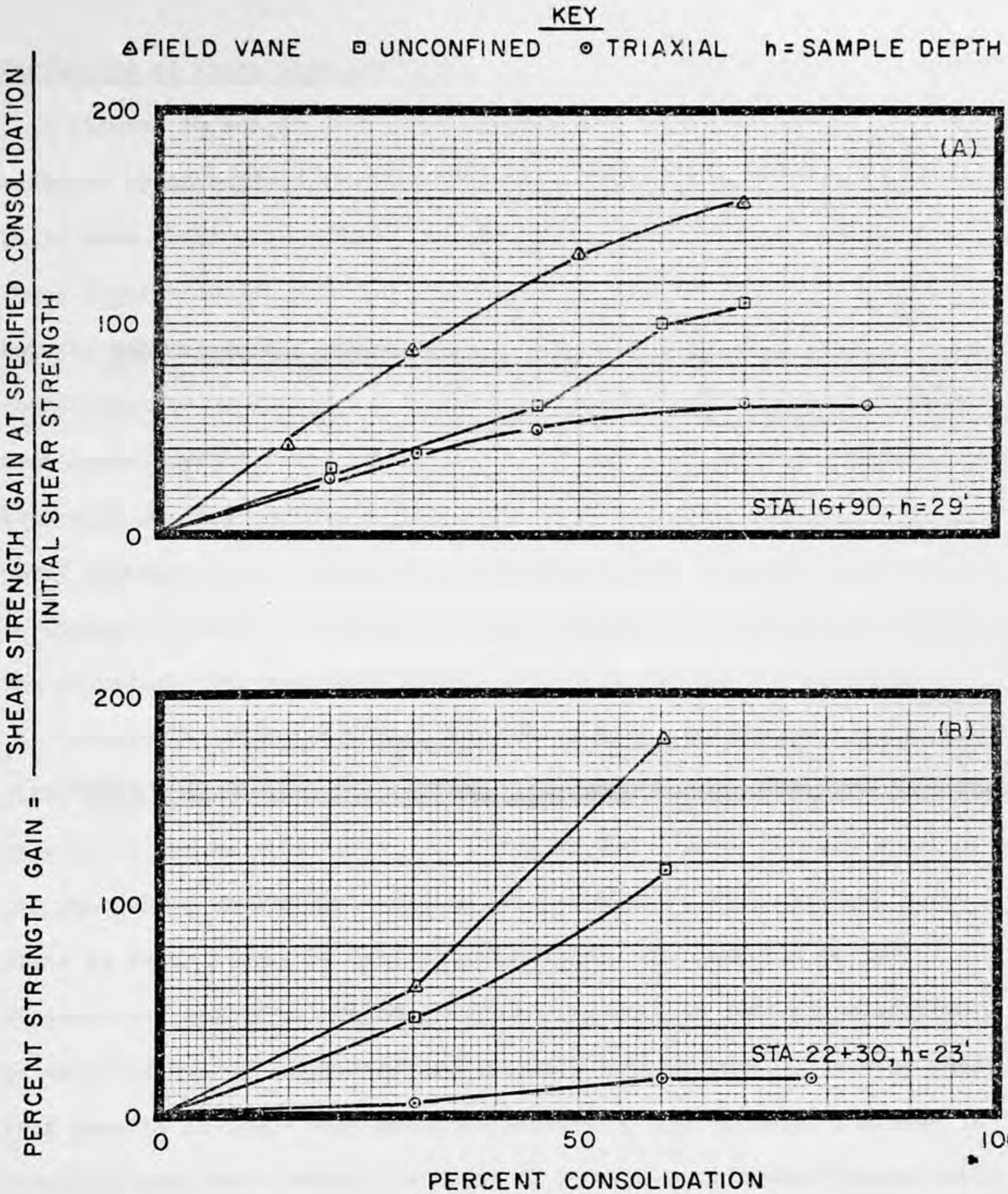


FIG. 13 COMPARISON OF SHEAR STRENGTH GAIN DUE TO CONSOLIDATION AS MEASURED BY TRIAXIAL, UNCONFINED, AND FIELD VANE TESTS

Percentage of Shear Strength Gain

Figures 14 and 15 show the percentage of shear strength gain as measured by unconfined compression, consolidated undrained triaxial, and field vane shear test methods at various stages of soil consolidation. These figures do not indicate the amount of increase in soil strength but the percentage of total increase at a specified consolidation. The total increase in strength is defined as the gain in strength at 100 percent consolidation. The percentage of strength increase is expressed as the ratio of shear strength gain at a specified consolidation to the shear strength gain at 100 percent consolidation. The tests presented in figures 14 and 15 correspond to soil samples at piezometer elevations. The properties of these soils are described in the previous section.

Figure 14A represents test results on soil samples corresponding to piezometer 7 elevation (Sta. 12+10). The soil in this area was described as soft to medium silty clay. As shown in the figure, in particular by the vane shear recordings, most of the increase in soil strength took place at later stages of soil consolidation. The increase in soil strength was nearly proportional to the increase in soil consolidation as revealed by the unconfined and triaxial test methods. The vane shear test results indicate that about 80 percent of the ultimate increase in strength took place during the final 50 percent soil consolidation while 20 percent of it occurred during the first 50 percent consolidation.

Figure 14B represents test results on soil samples corresponding to piezometer 10 elevation (Sta. 14+10). The soil in this area was described as medium to stiff organic silty clay with seams of fine sand. In this case a faster rate of increase in soil strength was measured than the case just described. As shown in the figure about 60 percent of the ultimate gain in strength took place during the first 50 percent soil consolidation while 40 percent of it took place during the final 50 percent consolidation. As shown in the figure the vane shear and the triaxial recordings are in close agreement. No increase in shear strength was measured with the unconfined test.

Figure 14 represents test results on soil samples corresponding to piezometer 13 elevation (Sta. 15+60). The soil in this area was classified as soft to medium varved silty clay. As shown in the figure, the bulk of the strength gain occurred during the first 30-40 percent soil consolidation irrespective of the test method utilized. At this stage the soil had attained about 60-70 percent of the total strength gain. The remaining 30-40 percent of the strength gain took place during the final 60-70 percent soil consolidation.

Figure 15A illustrates test results on soil samples corresponding to piezometer 16 elevation (Sta. 16+90). The soil in this area was classified as medium to stiff organic silty clay with a trace of fine sand. As shown in the figure about 80 percent of the increase in soil strength took place when the soil had reached 40-50 percent consolidation. This indicates a sharp increase in soil strength during the initial stages of soil consolidation and a much lower rate at the later stages of soil consolidation. The results of the three test methods indicate a good correlation.

Figure 15B illustrates test results on soil samples corresponding to piezometer 22 elevation (Sta. 22+30). The soils in this area were classified as very soft to soft, varved, organic silty clay. As shown in the figure, the rate of strength increase was slower during the beginning stages of soil consolidation as compared to the later stages. For example, during the first 60 percent consolidation the soil has gained only 40 percent of the ultimate strength gain while the remaining 60 percent of the strength gain occurred during the period between 60 to 100 percent consolidation.

In summary, it appears that for most clays investigated in this study the bulk of the strength gain occurred during the initial stages of soil consolidation. With the exception of soft to very soft clays, most other clays yielded about 70 percent of the total strength gain during the initial 40-50 percent soil consolidation. In soft to very soft clays most of the strength gain took place during the final stages of soil consolidation. It appears that for most clays in this area, by knowing the rate of pore pressure dissipation and the increase in soil strength, considerable time can be saved by expediting embankment construction. Laboratory tests, similar to the triaxial tests conducted in this experiment, can be set to predict the strength characteristics of the soils in the field. Hence, one does not need to depend entirely on pore pressure dissipation in controlling embankment loading.

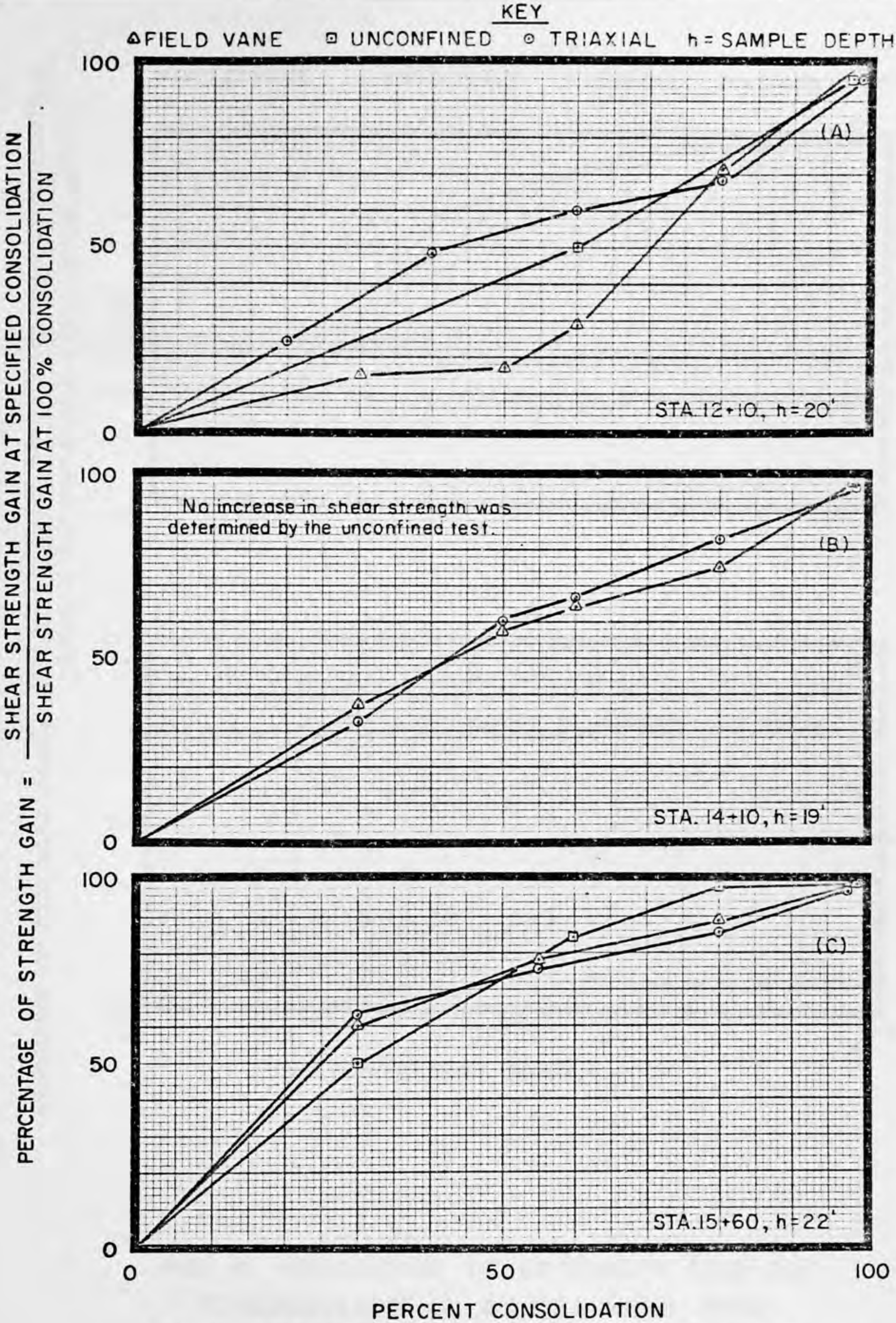


FIG. 14 PERCENTAGE OF STRENGTH GAIN DUE TO CONSOLIDATION AS MEASURED WITH UNCONFINED, TRIAXIAL, AND FIELD VANE TESTS

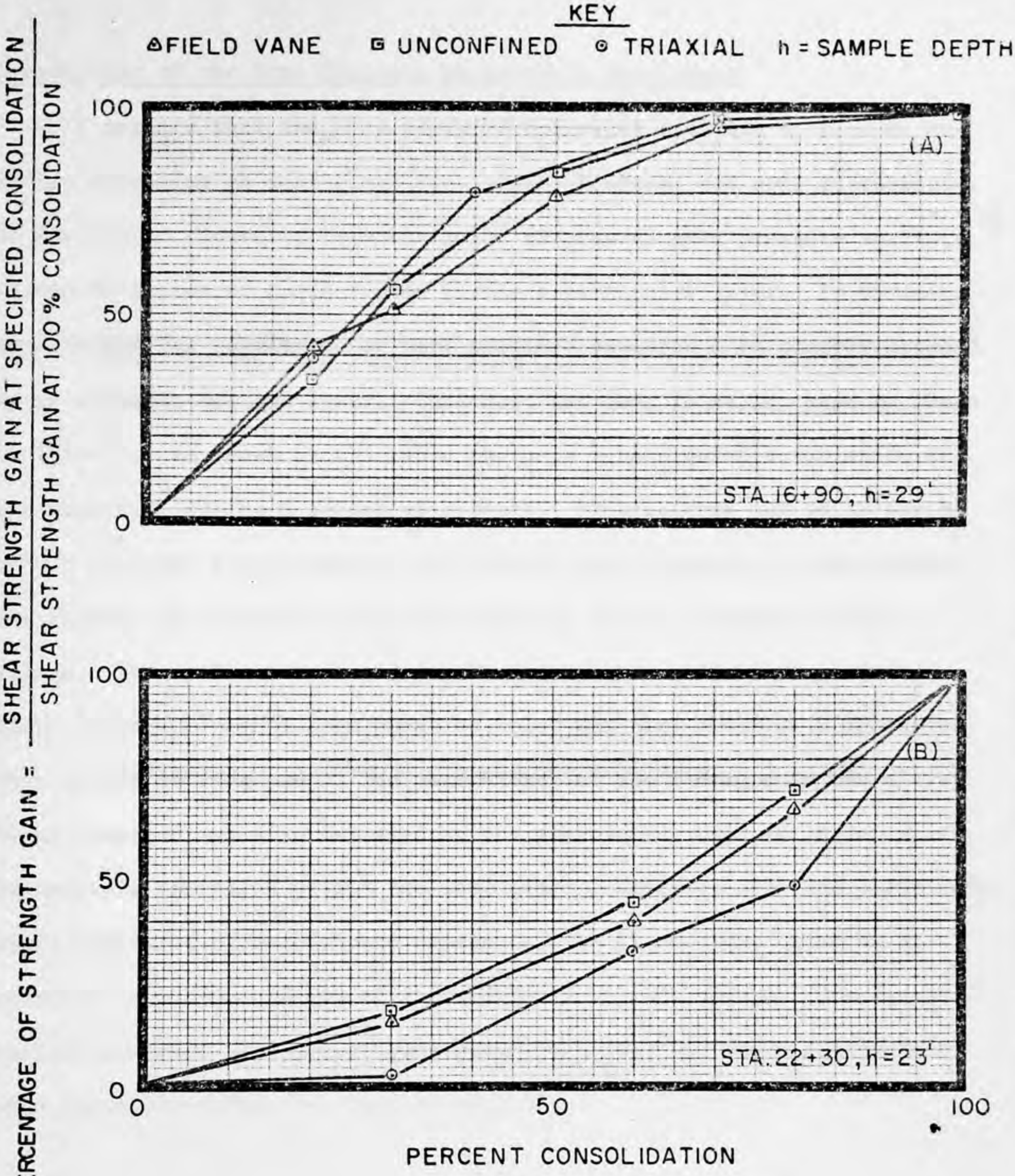


FIG. 15 PERCENTAGE OF STRENGTH GAIN DUE TO CONSOLIDATION AS MEASURED WITH UNCONFINED, TRIAXIAL, AND FIELD VANE TESTS

Anisotrophy of the Pore Pressure Parameter A with Depth

It appears that the pore pressure parameter A is not a constant but varies depending on soil structure, stress history, and soil disturbance. Of particular interest, from the point of view of pore pressure analysis, is the variation of the A factor within a particular layer. In choosing an A factor for settlement or pore pressure analysis A is uaually assumed to be constant for the layer. This does not seem to be the case as shown in Table 6. As shown in the table there is a considerable variation in the magnitude of the A factor with depth. This is true for soils having nearly the same classification and within close proximity of each other. The results do not show a definite trend as to the direction of the change. The soils encountered in this study were seldom homogeneous. Their structure varied from point to point and they frequently contained thin layers of fine sand. The variability of the A-factor in the clayey layers studied was also revealed by the piezometers used in these layers. Piezometers installed within the same layer, nearly at the same elevations, often indicated different pore pressures. At times, this could be attributed to malfunctioning of the equipment but not always. The stress variations would also affect pore pressure values but these piezometers were installed within 3-4 feet of each other.

TABLE 6

PORE PRESSURE PARAMETER A WITH SAMPLE LOCATIONS
AND SOIL IDENTIFICATION DATA

Sample Sta.	Sample Depth, Ft.	Soil Description	AASHO	LL%	PL%	W%	A-Factor
12+10	19	Clay	A-7-6(13)	44	23	31	0-0.20
13+80	33.5	Clay with a trace of fine sand	A-7-6(15)	52	29	54	0.70
14+10	24	Silty clay with fine sand	A-6(9)	35	23	31	0.30
	35	Organic clay	A-7-6(12)	42	22	29	0.80
15+60	15	Clay	A-6(10)	39	21	25	0.50
	20	Silty clay	A-6(10)	38	24	30	0.70
	25	Silty clay with a trace of find sand	A-7-6(14)	44	24	44	0.30
	30	Varved clay	A-7-6(20)	60	29	58	1.00
16+53	20	Organic silty clay	A-7-6(10)	43	27	43	0.75
	24	Silty clay with a trace of fine sand	A-7-5(11)	48	32	51	0.50
	29	Silty clay with a trace of find sand	A-6(9)	36	23	37	0.80
16+90	19	Silty clay	A-6(10)	39	22	43	0.50
	34	Clay	A-7-6(11)	41	23	34	0.50
22+30	24	Organic silty clay	A-6(9)	36	23	40	0.80

Piezometers

Two pneumatic piezometers (51402, Slope Indicator Co.) were used in this study as a check on the reliability of the hydraulic (Casagrande) piezometers. These are shown as piezometers 10 and 12 in Appendix II. One pneumatic piezometer (No. 10) indicated a higher pore pressure than the adjacent hydraulic piezometer while the other (No. 12) showed lower pore pressure. With the few number of piezometers installed it is difficult to draw a definite conclusion as to the reliability of these piezometers. However, the pneumatic piezometers are easier to operate and they are less expensive in cost. They do not require a separate housing box for each individual piezometer as do hydraulic piezometers. One indicator unit can be used for all piezometers in a project. For the Utah State Highway Department to make the switch at this stage of the operations is not recommended. The state owns many hydraulic piezometers which could last for several years.

CONCLUSIONS

(1) The stresses calculated beneath an embankment loading, using the elastic theory method, were nearly the same as those calculated by Boussinesq's solution but they were considerably higher than the stresses calculated using the finite element method.

(2) Boussinesq's and the elastic theory methods both result in an over estimation of the applied stresses. Hence, a designer is being conservative in using either method.

(3) The predicted pore pressures, using stresses determined by the finite element method, were surprisingly close to those actually measured in the field. The predicted pore pressures, using stresses determined by the elastic theory method, were considerably higher.

(4) Skempton's equation, used in this study, assumes no pore pressure dissipation during construction. This assumption is not valid for soils in this area as shown in Figures 17 through 28, Appendix II. These figures show a continuous dissipation of pore pressure during construction. The predicted pore pressures would have been higher if the dissipated pore pressures were not considered.

(5) The rate of pore pressure increase $(\frac{\Delta u}{\Delta\sigma_1 - \Delta\sigma_3})$, after a construction shutdown period, is believed to be less than the increase prior to construction shutdown. The phenomenon was difficult to observe in the field because of the short time lapse between two consecutive loadings. On the other hand, laboratory tests duplicating field conditions indicated a sharp drop in the rate of pore pressure gain for samples sheared between 0 and 25 percent consolidation, hence, verifying

the phenomenon. For samples exceeding 25 percent consolidation the situation was reversed, the rate of pore pressure gain was gradually increased. The drop in the rate of pore pressure is possible for at least two reasons, viz., first, soils gain strength during the construction shutdown period and when reloaded a lesser percent of the applied loading is transferred to the pore water, and second, the rate of pore pressure dissipation is increased at higher applied stresses. Further study in this area is recommended.

(6) The in situ vane shear values were nearly of the same magnitude as those obtained by the conventional unconfined compression and triaxial test methods except for soft to very soft clays where the vane shear test results were considerably higher. For soft to very soft clays the triaxial and the vane test results were in close agreement but the samples in triaxial tests had to be intially back-pressure saturated and then completely consolidated under the in situ overburden pressure.

(7) The increase in soil shear strength was not constant for all soils. Some clays gained more strength than the others for equal consolidation pressures. Quick clays lost strength during the initial stages of soil consolidation.

(8) For most clays investigated in this study the bulk of the strength gain occurred during the initial stages of soil consolidation. With the exception of soft to very soft clays most clays developed about 70 percent of their ultimate strength gain during the initial 40-50 percent soil consolidation. In soft clays most of the strength gain took place during the final stages of soil consolidation.

(9) The pore pressure parameter A was not constant in a clayey layer but varied from point to point.

RECOMMENDATIONS

Field vane shear tests together with in situ measurements of pore pressures are recommended for monitoring embankment construction over soft foundations.

Field vane shear tests are subject to interpretation and should not be used without soil identification tests. They should also be supplemented with other types of shear tests.

Laboratory consolidated undrained triaxial tests, similar to those conducted in this study, are recommended for predicting the rate and the amount of soil shear strength gain due to consolidation.

More research is needed concerning the reliability of the finite element method of stress determination in soils.

More research is recommended concerning the theory for pore pressure prediction, taking into account pore pressure dissipation during construction. Possibly laboratory tests used in determining the pore pressure coefficients should be modified to duplicate field conditions.

The anisotropy of the pore pressure coefficient A, characteristics of clays encountered in this area, requires futher study.

After a construction shutdown period the rate of pore pressure increase with increasing stresses is believed to be less than the increase prior to construction shutdown. Further research in this area is recommended.

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APPENDIX I

Summary of Test Data

Summary of Test Data

ring ta.	Depth	Grading Analysis Percent: Gravel	Coarse Sand	Fine Sand	Silt and Clay	Group Classification	Atterberg Limits: Liquid Limit w_L	Plastic Limit w_P	Water Cont. w %	Wet Unit Weight γ P.C.F.	Dry Unit Weight γ_s P.C.F.	Specific Gravity Gs	Permeability k 10^{-4} cm/sec. Hor.	Vert.	Unconfined Strengh q_u T.S.F.	Shear Strength Unconsolidated $\phi°$	C T.S.F.	Consolidated $\phi°$	C T.S.F.	Time hrs.	Pres P.S
0+00	5S	0	3	6	91	A-6(9)	34	21	26	125	99	2.74									
	6.5		Tan clayey silt w/thin sand lenses												0.342*						
	8.5S	0	1	8	91	A-6(10)	32	18	22	128	105				1.27						
	16.5		Tan clayey silt w/thin sand lenses												1.88*						
	18.5S	0	1	1	98	A-6(10)	36	22	27	124	97				2.24						
	22S	0	2	7	91	A-7-6(13)	47	28	37	117	86		.0007	.0006							
	23.5		Grey silty clay with thin sand lenses												1.33*						
	25.5S	0	1	5	94	A-7-6(16)	49	24	50	96	64				1.13						
	52	0	7	12	81	A-6(11)	39	21	22												
14+00	5	6	22	25	47	A-4(2)	26	20	27												
	12S	1	1	37	61	A-4(5)	18	NP	28												
	16	0	1	29	70	A-6(11)	40	20	30												
	22S	0	1	6	93	A-6(9)	34	22	32	117	88				0.96						
	26	0	0	3	97	A-7-6(17)	51	25	47	104	70				0.61						
	41	0	5	11	84	A-6(10)	35	19	22												
	51	0	7	17	76	A-6(12)	39	20	31												

S–Shelby Sample P–Penetration Sample T–Triaxial Shear Test D–Direct Shear Test C–Consolidation Test *Vane Shear Tests

Summary of Test Data

Boring Sta.	Depth	Grading Analysis Percent: Gravel	Coarse Sand	Fine Sand	Silt and Clay	Group Classification	Atterberg Limits: Liquid Limit w_L	Plastic Limit w_P	Water Cont. w %	Wet Unit Weight γ P.C.F.	Dry Unit Weight γ_s P.C.F.	Specific Gravity Gs	Permeability k 10^{-4} cm/sec. Hor.	Vert.	Unconfined Strengh q_u T.S.F.	Shear Strength Unconsolidated $\phi°$	C T.S.F.	Consolidated $\phi°$	C T.S.F.	Time hrs.	Pr PS
17+00	2S	3	5	20	72	A-7-5(16)	54	32	47	104	71	2.63									
	11	0	1	3	96	A-6(13)	39	17	26												
	12	0	1	7	92	A-6(9)	35	22	26												
	22	0	0	3	97	A-6(9)	36	23	34												
	32	0	0	3	97	A-7-6(17)	48	22													
	42	0	0	23	77	A-6(10)	32	18	24												
	47S	1	10	14	75	A-6(12)	40	21	24	128	104	2.71			2.04						
20+25	7	0	2	8	90	A-6(10)	36	22	30.0												
	27S	0	1	4	95	A-4(8)	38	28	54.0	103	67	2.80		003.0	0.47						
	62	Grey	clay	w/some	sand				35.0	105	78				1.63						
21+50	12	0	0	6	94	A-7-6(12)	42	22	29.0	108	83				1.04						
	17S	0	0	11	89	A-6(9)	35	22	44.0	111	77	2.73									
	27S	9	2	2	87	A-4(8)	37	27	47.0	107	73				0.37			11°	.13	4	15 & 30
	37S	0	0	1	99	A-7-6(20)	59	27	50.0	107	72	2.73			1.03						
	47	0	34	40	26*	A-2-4		NP													
	57	Grey	silty	clay	w/sand				20.0	125	104				2.0						

S–Shelby Sample P–Penetration Sample T–Triaxial Shear Test D–Direct Shear Test C–Consolidation Test

APPENDIX II

Piezometer Details and Installation Techniques

Field Recordings of Excess Pore Pressure

PIEZOMETER DETAILS AND INSTALLATION TECHNIQUES

Piezometers

Twelve hydraulic (Casagrande) and two pneumatic (51402, Slope Indicator Co.) piezometers were used to monitor the pore pressures. The pneumatic piezometer consists of a 3-½ inch long 1-½ inch diameter transducter which is connected to a porous stone 6 inches long by 1-½ inches O.D. and 1-inch I.D. Overall length is 13 inches. This includes the porous stone, the cap and two 1/8-inch tube fittings on the upper end allowing two nylon tubes to be connected for input and output air lines to the ground surface. Pore-water pressure acts upon a rolling, flexible diaphragm having negligible spring force. A small movement of the diaphragm due to water pressure causes a sensitive ball 'check valve' to open. Air pressure is applied to the input fitting causing flow through the valve, the diaphragm chamber and into the output line which is connected to a suitable pressure gauge. Flow through the valve increases pressure in the two lines until it equals the pore-water pressure. When the forces on the diaphragm become equal, the diaphragm will move slightly in the other direction allowing the check valve to close. At this point, the pressure in the output line equals the pore-water pressure. Pressure can be increased in the input line, but there will be no flow and therefore no change in the output pressure. Figure 16 shows a diagram of the system in a graphic form.

The hydraulic piezometer consists of a hollow porous stone tube 1½ inched O.D. and 12 inches long. One end of the tube is plugged while the other end connects to a ½ inch O.D. polyethylene tubing. The polyethylene

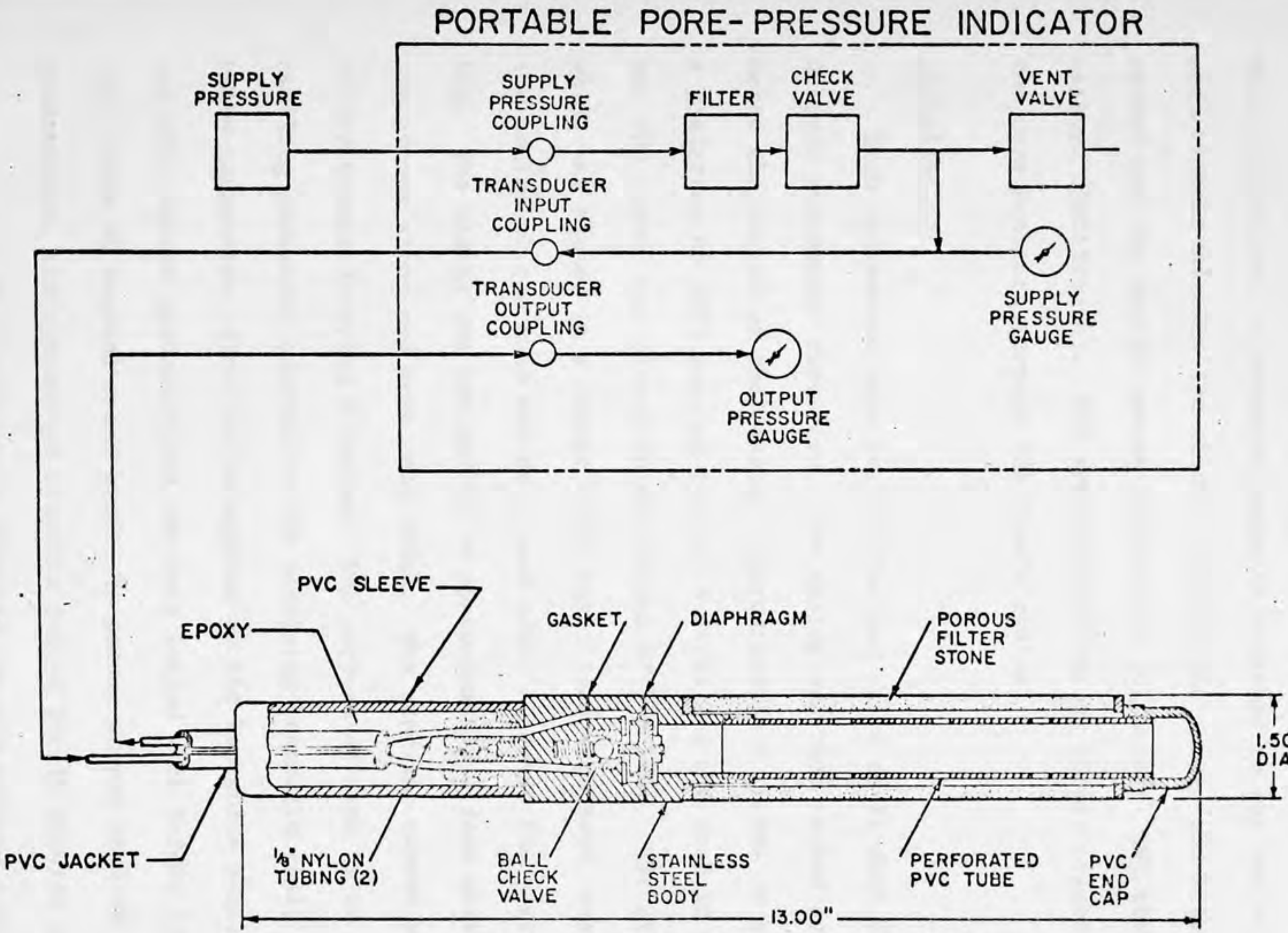

FIG. 16

PORE-PRESSURE SYSTEM (PNEUMATIC DIAPHRAGM TYPE)

SLOPE INDICATOR CO.
Seattle, Washington

tubing extends vertically to the surface where it connects to a double line of polyethylene tubing at a brass "T" at the top of the hole. The purpose of double tubing is to flush air out of the system and to insure full saturation. A pressure gauge is attached to one end of the tubing and a bleeder valve to the other. To fill the system the bleeder valve is opened and the entire system filled with 50% water - 50% ethylene glycol mixture (Antifreeze). The system functions by direct transmission of the pore pressure through the liquid medium.

Installation

Each piezometer hole was drilled and cased to 1½ feet above the desired piezometer elevation. The casing was then washed out to 1½ feet below the bottom of the casing. Approximately 6 inches of sand, having a gradation of 100% passing the No. 8 sieve and not over 6% passing the No. 200 sieve, was placed in the bottom of the hole. The piezometer which was placed in a cheese cloth bag filled with sand, was dropped to the bottom of the hole and more sand added to cover the space around the bag. The casing was now pulled to approximately 1 foot above the top of the porous stone and more sand added. The sand was tamped with 10 blows of the hammer dropping 6 inches. The purpose of sand is to minimize the swelling pressures exerted by the overlying bentonite seal, and to permit heavy compaction effort to be applied to the bentonite seal. The casing was then raised gradually and the hole sealed with 5-four inch alternating layers of bentonite and sand. To assure proper seal of the hydraulic piezometers, the system was pressure tested for 10 minutes under a 5 psi air pressure. No seal test is provided for the pneumatic piezometer. Finally, the leads connecting to piezometers were buried in an 18 inch trench dug in a 2 foot thick sand blanket. The pressure gauge and the bleeder valve of hydraulic piezometers were placed in a "Housing Box" outside the toe of the embankment fills. The leads for the pneumatic piezometer were placed in a plastic bag outside the toe of the embankment.

Graphical Presentation of Field Pore Pressures

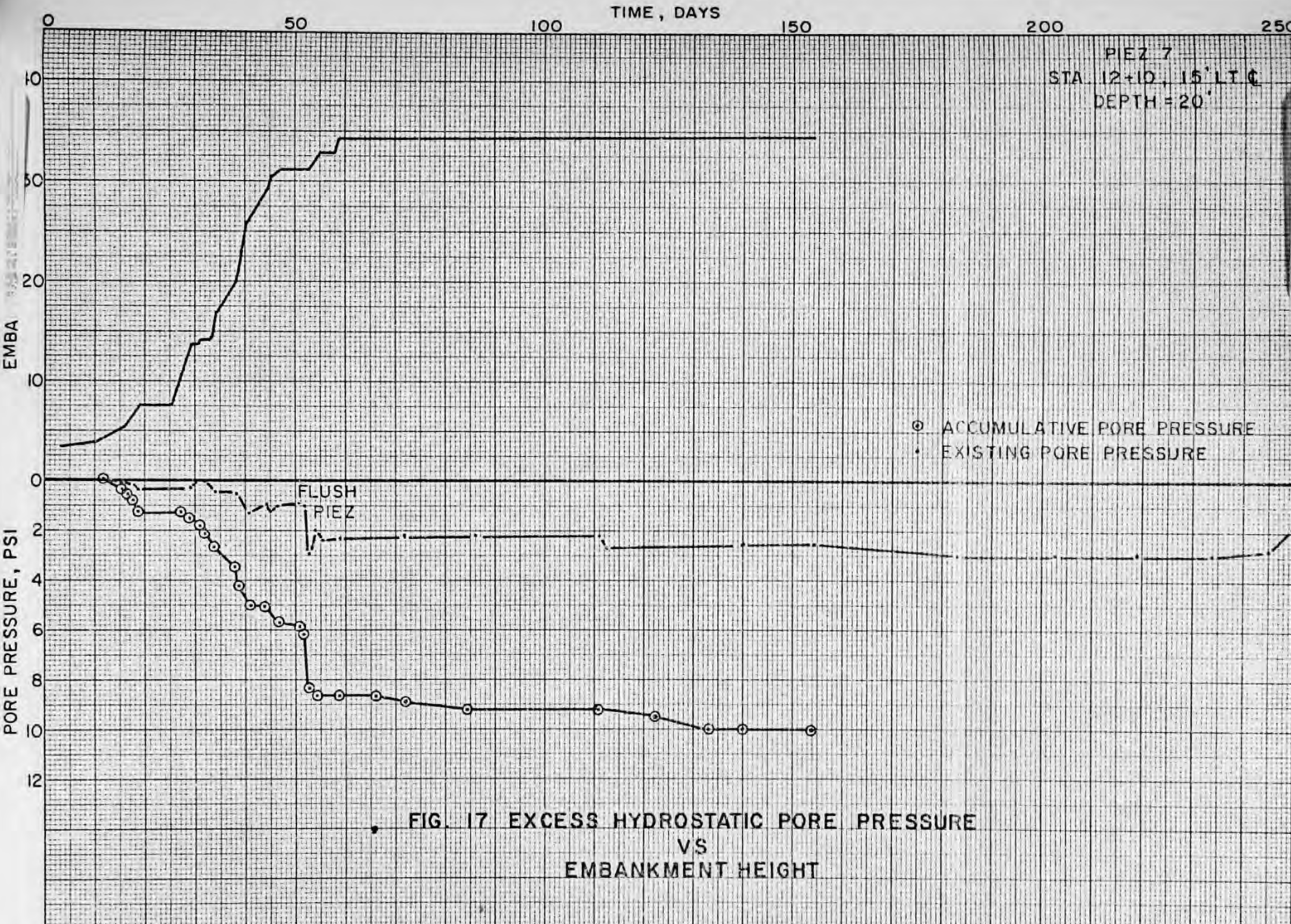

FIG. 17 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

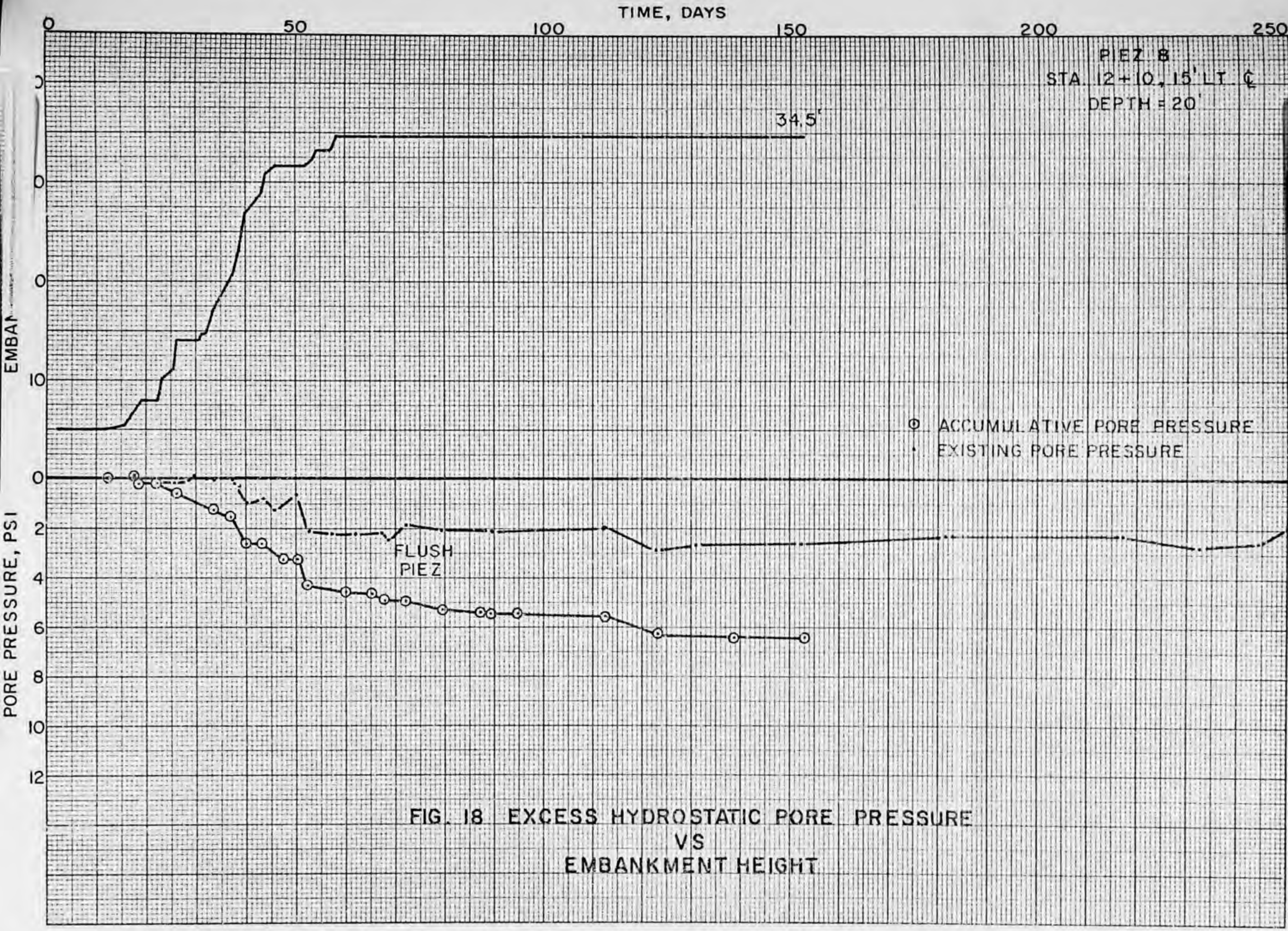

FIG. 18 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

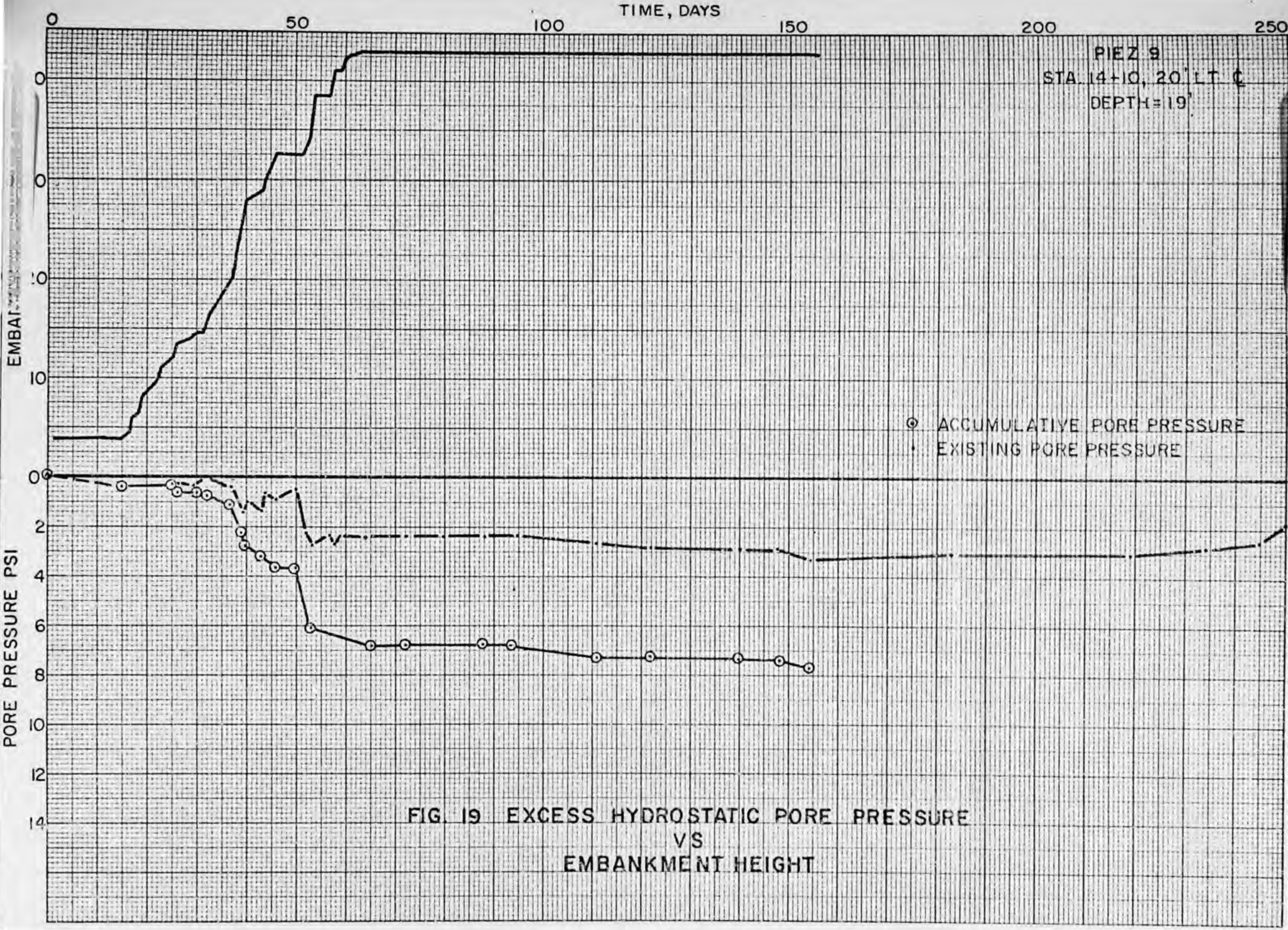

FIG. 19 EXCESS HYDROSTATIC PORE PRESSURE
VS
EMBANKMENT HEIGHT

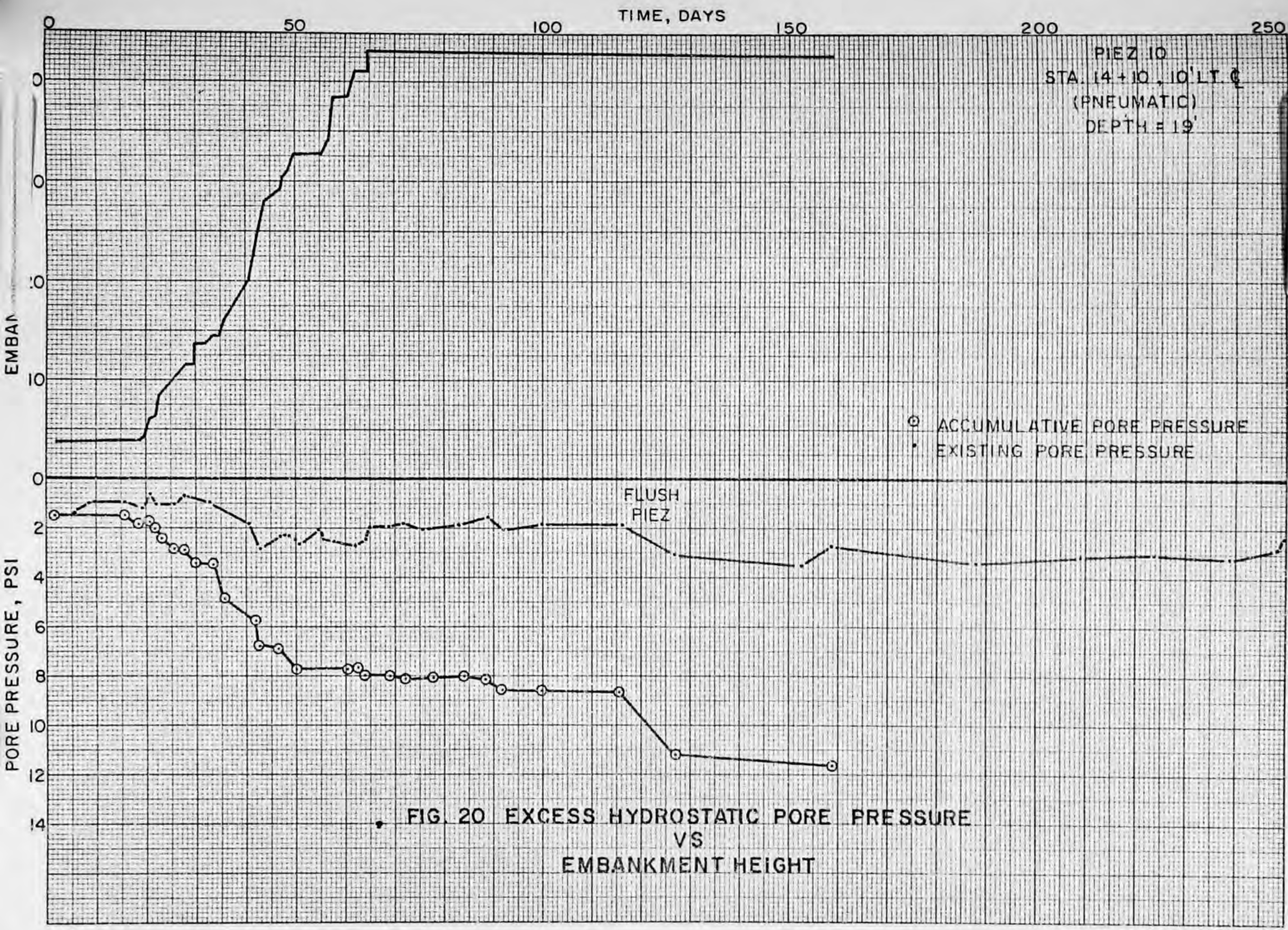

FIG. 20 EXCESS HYDROSTATIC PORE PRESSURE
VS
EMBANKMENT HEIGHT

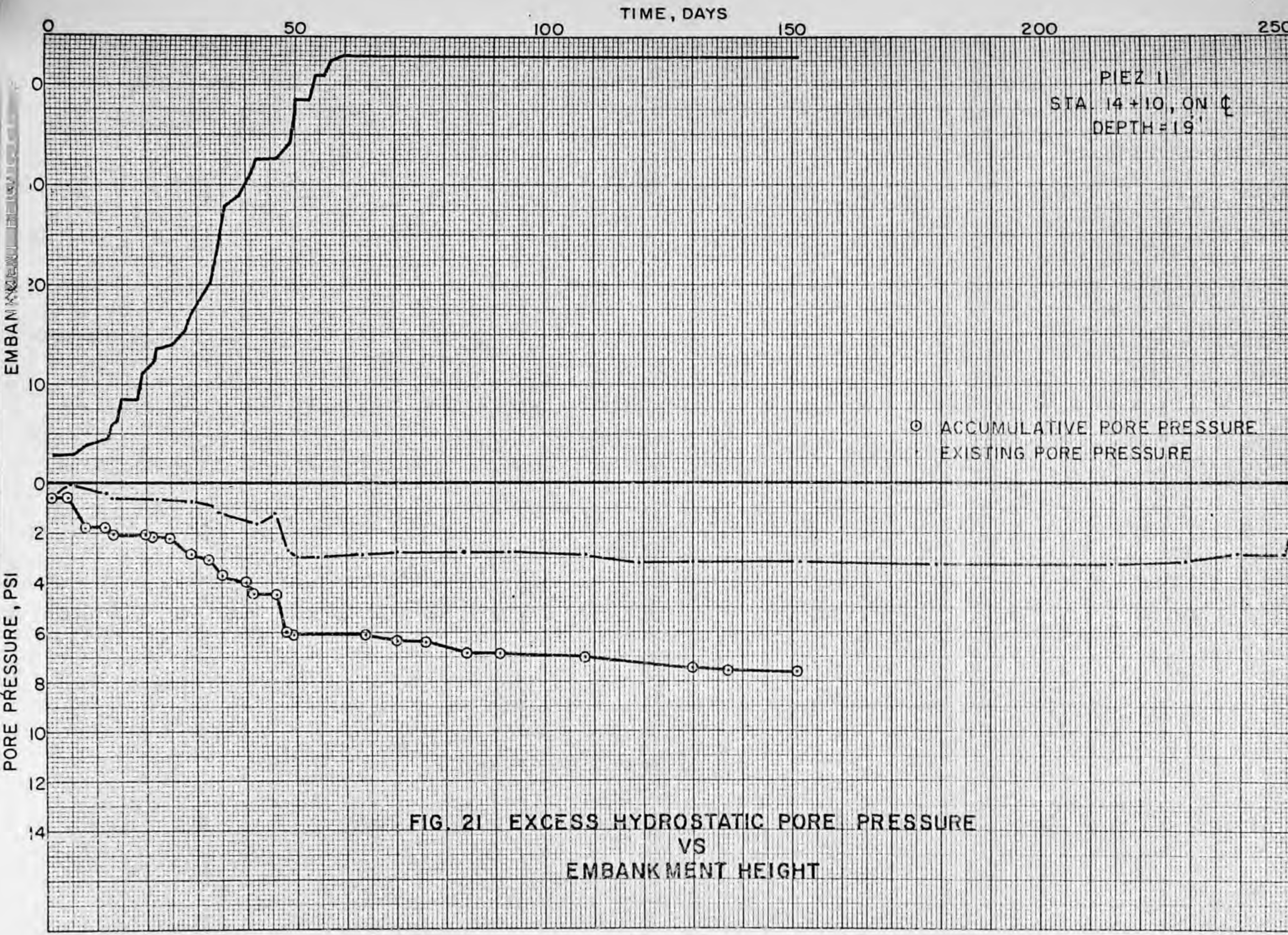

FIG. 21 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

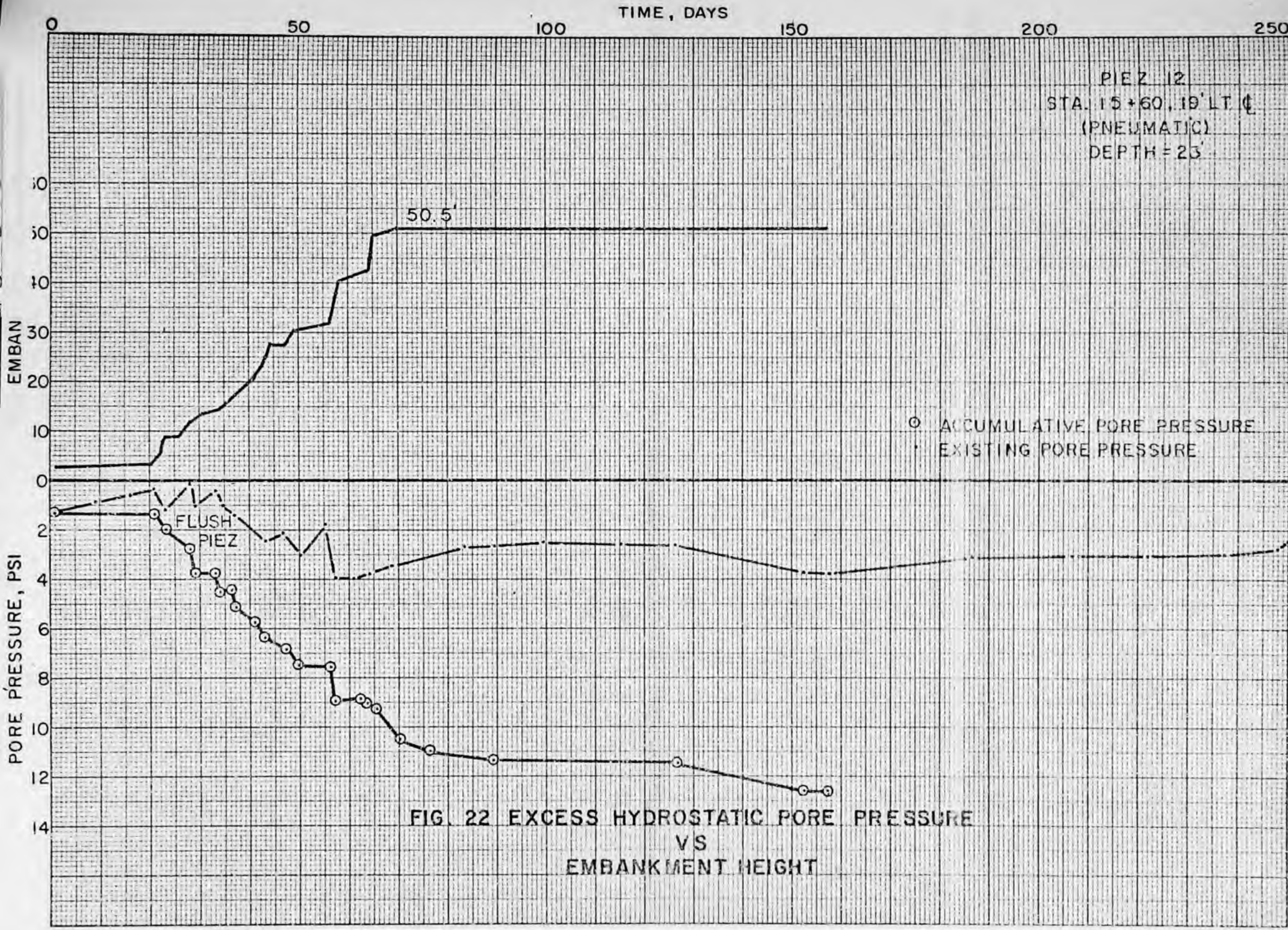

FIG. 22 EXCESS HYDROSTATIC PORE PRESSURE
VS
EMBANKMENT HEIGHT

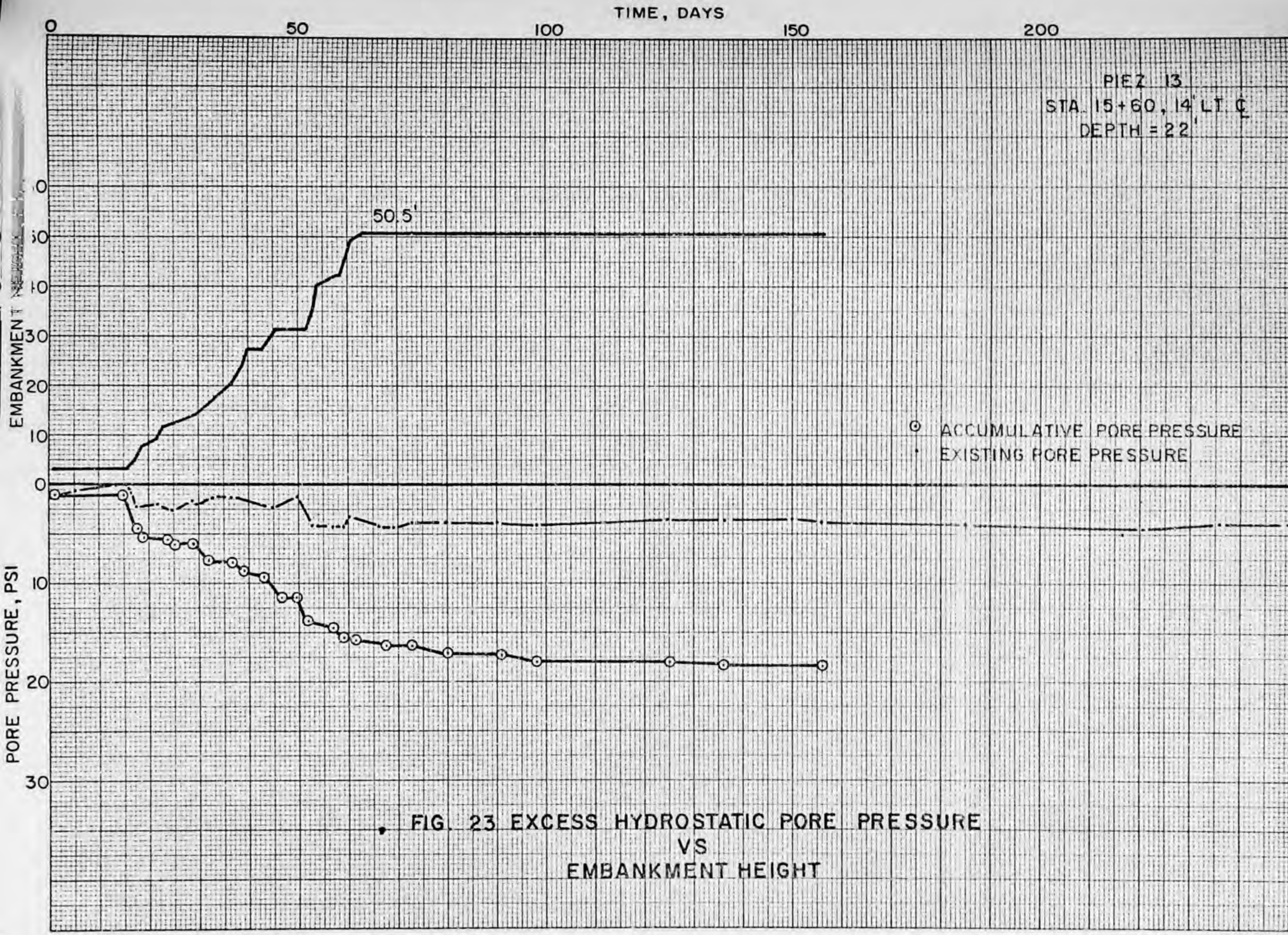

FIG. 23 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

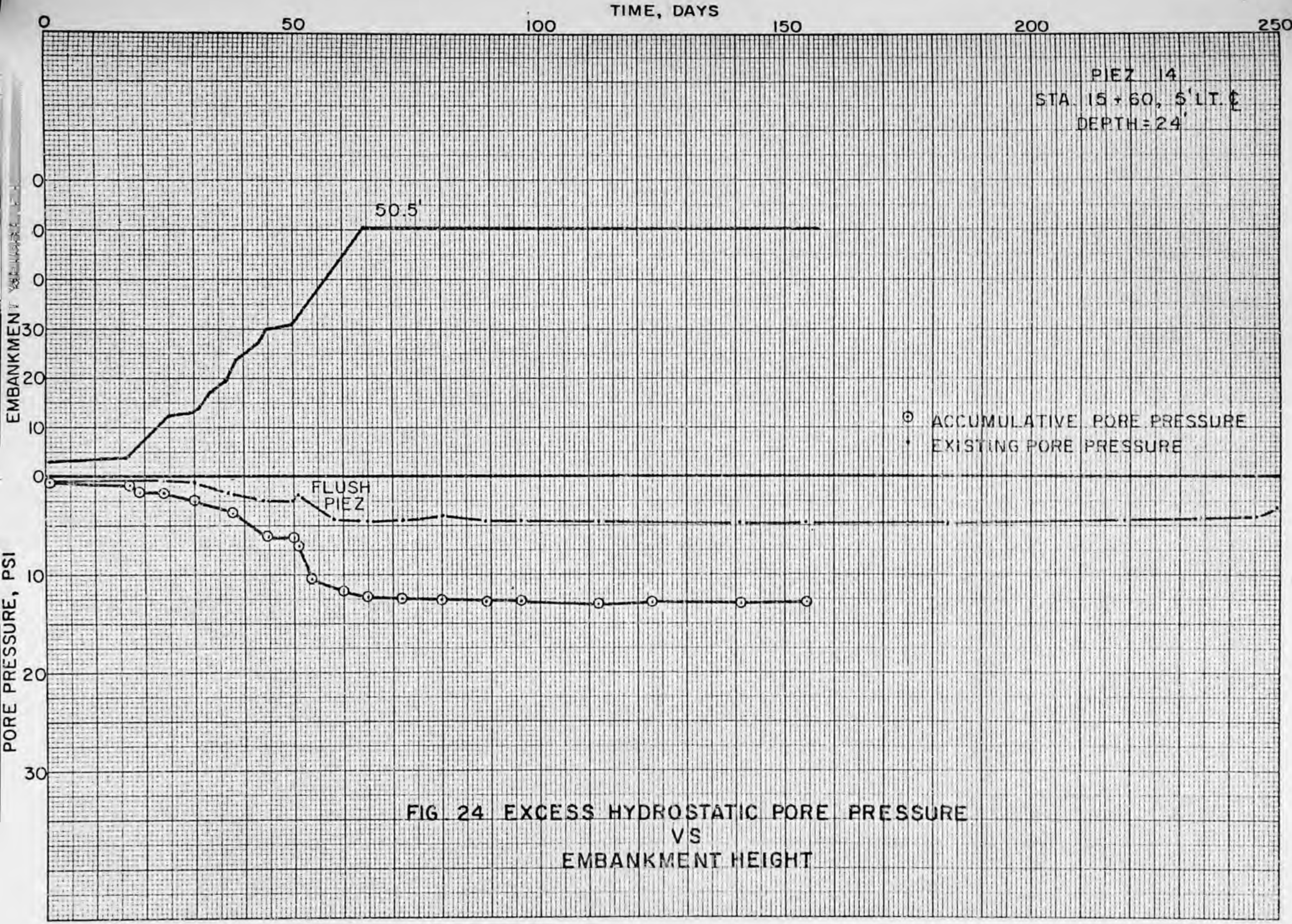

FIG. 24 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

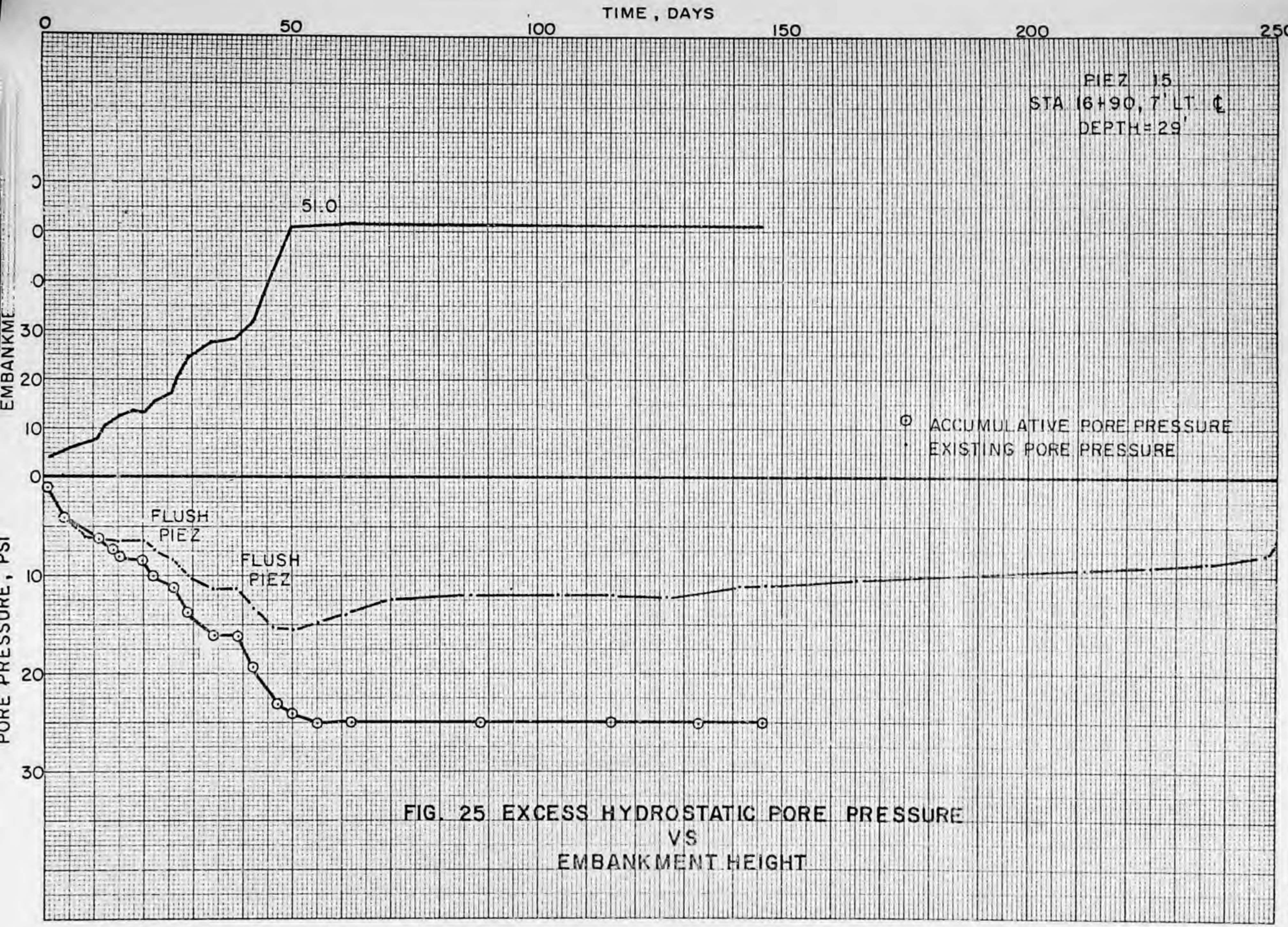

FIG. 25 EXCESS HYDROSTATIC PORE PRESSURE
VS
EMBANKMENT HEIGHT

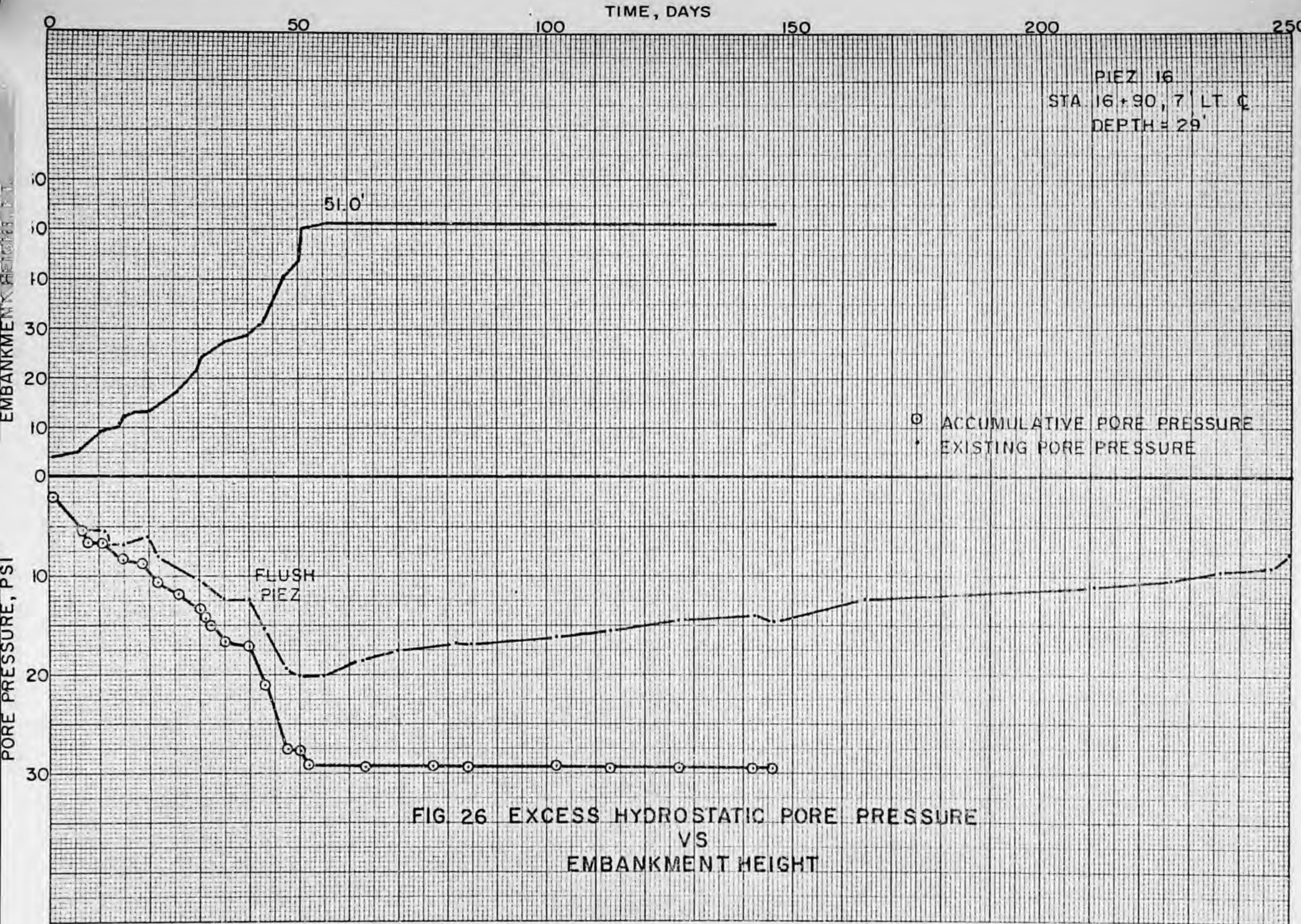

FIG. 26 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

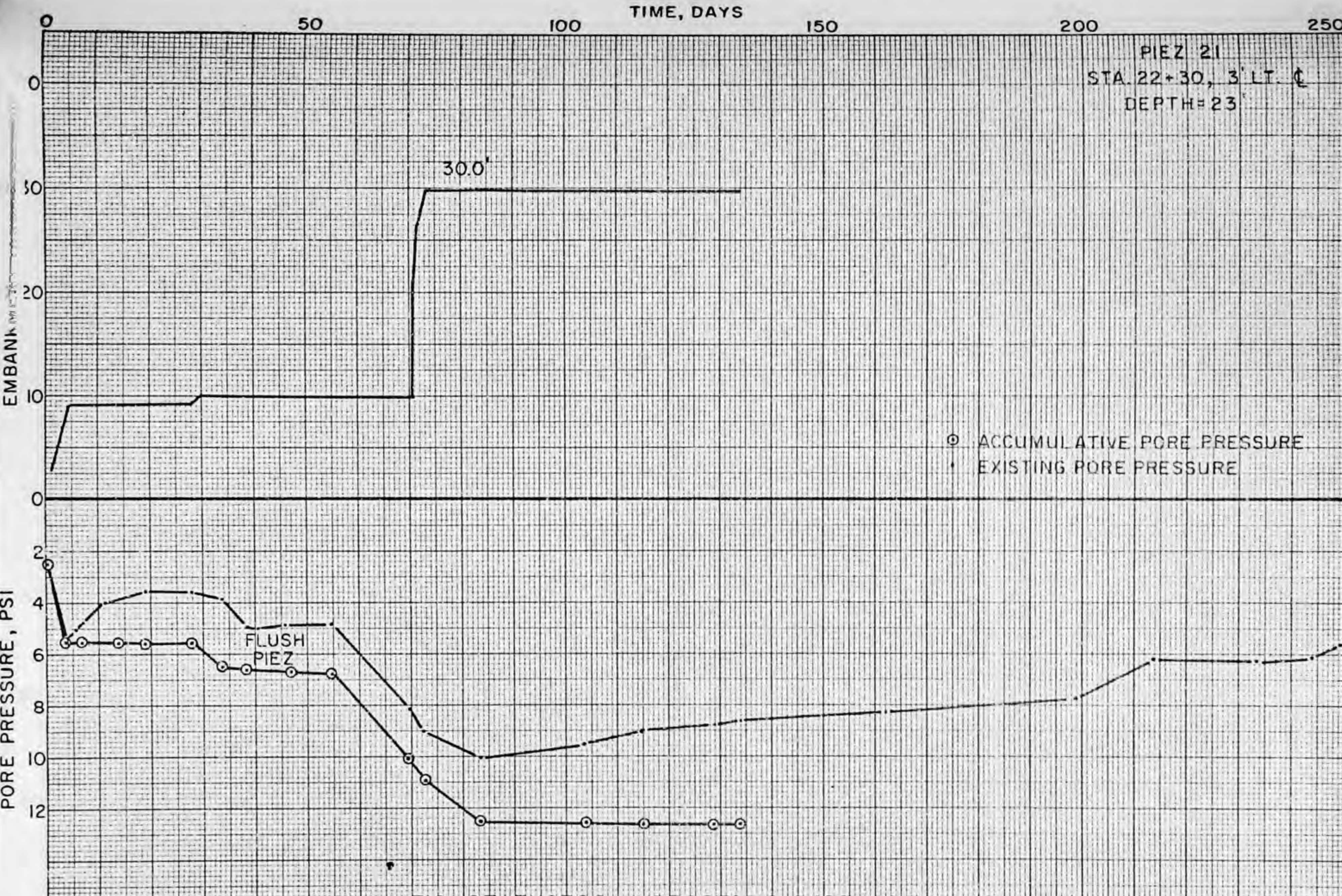

FIG. 27 EXCESS HYDROSTATIC PORE PRESSURE VS EMBANKMENT HEIGHT

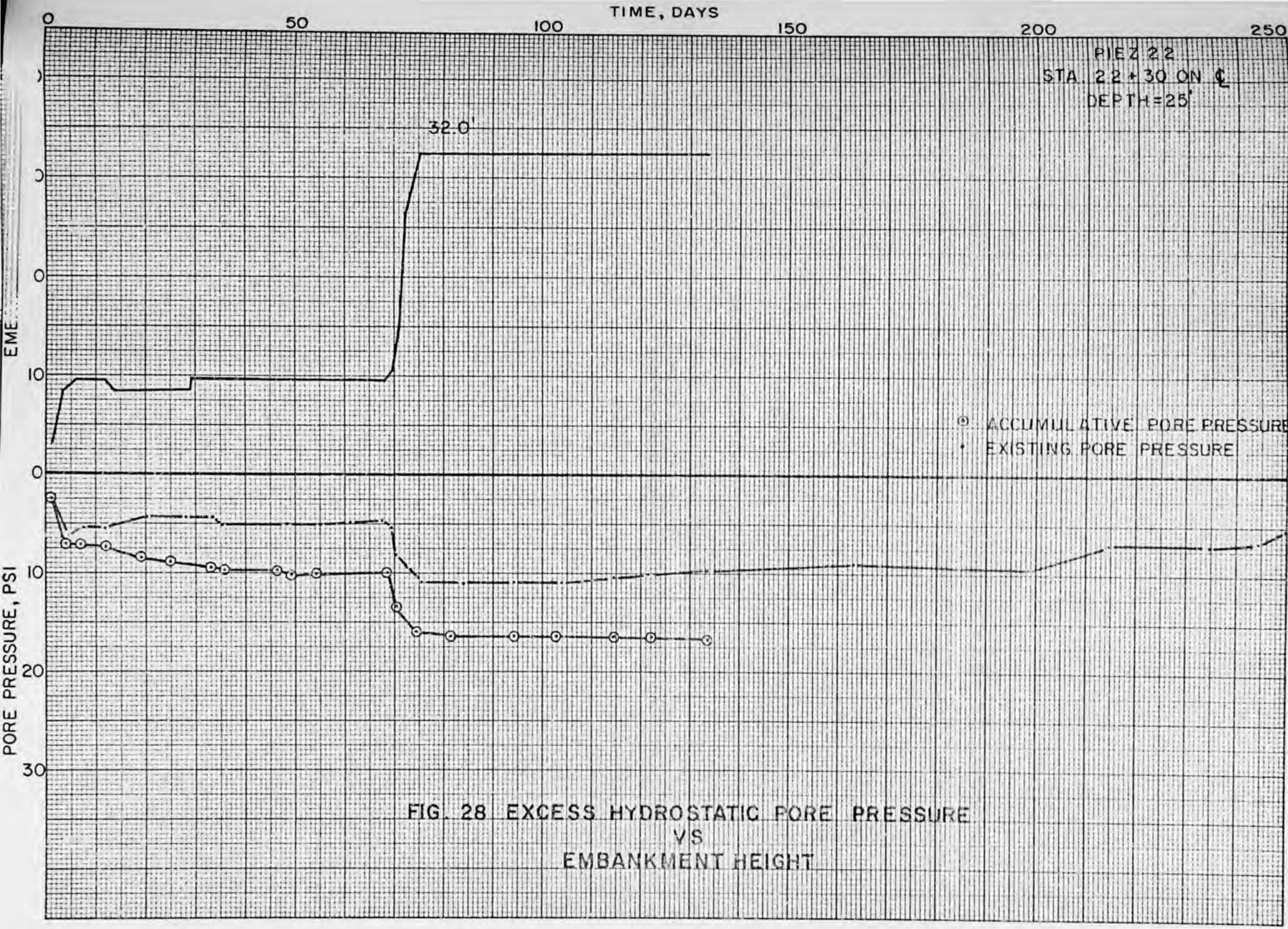

FIG. 28 EXCESS HYDROSTATIC PORE PRESSURE
VS
EMBANKMENT HEIGHT

APPENDIX III

Details of Laboratory Testing

Machine Preparation
Sample Preparation
Testing Procedure

DETAILS OF LABORATORY TESTING

Strain controlled triaxial consolidated quick tests were used in the study for measuring pore pressures. This required a careful preparation of the pore pressure apparatus and the specimen tested. The following is a general description of the machine preparation, the sample preparation, and the testing procedure.

Machine Preparation

To fill the pore pressure apparatus all valves on the panel (Fig. 6, Page 32) were closed and the "Inlet to Pump" connected to a reservoir of de-aired distilled water. Water was drawn into the system by turning the pump handle counterclockwise. Extra care was taken not to draw air into the system. To assure that no air was drawn in, the system was checked by screwing in the piston slightly and observing that no air bubbles were returned through the pump inlet.

After the pump was filled, valve "J" was closed and the valves "L" and "N" were opened. This connected the pump and the pressure gauge systems. The gauge was bled by carefully releasing a screw in the back of the panel. The screw was then retightened.

The system connecting the null indicator to the sample and to the burette was then filled by opening valves "K" and "F". Any entrapped air in the system was released by opening the two bleed valves "X" and "Z", and by allowing water to escape to the burette and to the triaxial cell.

When the entire system was filled and de-aired, all the leads and the valves were checked for leakage under pressure. This was achieved by opening the valves (K, L, M, N, F) and closing the opening to the triaxial chamber. The air supply valve "B" was then opened and the entire system checked at 60 psi pressure for 5 minutes.

Sample Preparation

Most samples tested were taken with 2 foot long 2.375 inch diameter Shelby tube samplers. Some Shelby tubes were 2 inches in diameter.

Trimming of sample - Because trimming left small cavities on the sample it was reduced to minimum if possible. This was done by cutting the sample to an exact height by using an electric saw. This reduced trimming considerably. Any cavities left on the sample would entrap air under the membrane thus making back pressure saturation extremely difficult.

Sample Set up - A saturated, boiled porous stone was placed on the base pedestal of the triaxial cell. Before placing the sample in the cell, water was continuously forced through the base porous stone by opening the burette to atmosphere. This forced out all the air bubbles in the pedestal openings and the bubbles entrapped between the pedestal and the porous stone filter. Care was taken not to empty the burette completely as this would have introduced air into the system. The burette was refilled with distilled de-aired water as it emptied.

Excess water on the porous stone was dabbed away before the test sample was centered on it. The top cap (loading pedestal) and a saturated porous stone were then placed on the sample, and the sample enclosed in a 2.36 x 8 x 0.012 rubber membrane (Test Lab. B30-97300) using a special tabular Membrane Jacket (Soiltest P-43). To remove the entrapped air between the sample and the membrane, the membrane was stroked gently against the sample in upward and downward directions until it was certain that all the air was removed. The membrane was now sealed against the caps by rubber O-rings. Two rings were used at each end of the sample.

For long duration testing the membrane was coated with a thin film of silicon to prevent water migration in and out of the membrane.

With the Burette valve "F" closed the cell was filled with water. The mercury level in the null indicator and the Bourdon gauge readings were adjusted while the cell was at atmospheric pressure.

Testing Procedure

Before shearing the samples the entire system was checked for hardness (no air in lines). Then each sample was back-pressure saturated and consolidated to in situ pressure.

Hardness test - To insure that the system is hard (free of air) an incremental pressure, ½-2 psi, was applied in the cell. If the pore pressure reaction was spontaneous, the system was assumed de-aired. If the reaction was not spontaneous, the system was de-aired again.

Back pressure saturation - When a soil sample is brought to the ground surface, air and other gases in the pore water expand due to increase of temperature and decrease of pressure, and the sample becomes less saturated. The neutral pore pressure in the sample is also decreased from that which existed in situ. If the soil is granular, the pore pressure is reduced to atmospheric. If the soil is cohesive, surface tension developes due to swelling of the sample and the pore pressure becomes less than atmospheric (30).

To be able to compare the predicted and measured excess pore pressure, the tests should be conducted with the same effective pressure and degree of saturation as existed in the field. In this experiment, the test samples were taken from below the ground water table where they were 100% saturated. In order to obtain fully saturated specimens in the laboratory, each sample was back pressure saturated (30). To obtain the same effective pressures as occurred in the field, the samples were consolidated.

A. Sample Saturation - With the valves K, L, and N opened small increments (5-10 psi) of cell pressure were applied on the sample. Simultaneously the mercury level in the null indicator was held constant by adjusting the back pressure. Each increment of cell pressure was allowed to equalize before a second increment was added. Time to equalization ranged from a few minutes to 36 hours. When the measured increment of back pressure (pore pressure) was equal to the applied increment of cell pressure, the sample was assumed completely saturated (i.e., B=1). At this point the pore pressure reaction due to changes in the cell pressure was spontaneous. For back pressure data sheets refer to Appendix IV.

B. Consolidation - Thirteen series of consolidated undrained tests, four tests in each series, were conducted in this study. One sample in each series was allowed to consolidate to 90-100 percent of the primary consolidation under effective pressure. The remaining three samples were consolidated under a load equivalent to effective induced embankment loading. These samples were sheared at various stages of consolidation. In order to consolidate the samples the valves "K" and "F" were closed and the chamber filled with the desired consolidation pressure. This is in addition to the book pressure required for sample saturation. Now a back pressure, equal to back pressure required for complete saturation, was maintained in the burette by opening valve "B". The burette valve "F" was then opened and the sample allowed to consolidate under the differential pressure.

C. Pore Pressure Measurements - With all the valves closed except "K", "L", and "N" the deviator stress ($\sigma_1 - \sigma_3$) was applied to the sample. Movement of water out of the sample was prevented by maintaining a constant mercury level. A constant strain rate of 0.002 inches per minute was used throughout the test. Simultaneous measurements of pore pressure (u), strain (ϵ), and the deviator stress ($\sigma_1 - \sigma_3$), were recorded. Recordings were made at approximately every 20 seconds at the beginning of the testing but later the interval was changed as the rate of stress change reduced. For test data sheets refer to Appendix IV.

D. End of Test - The cell pressure was released and the cell water drained. The pore pressure apparatus was isolated by closing valve "K". After removing the membrane, O-rings, and the caps, the sample was reweighed. The amount of water lost during consolidation was thus checked with the amount of water measured in the burette. Three moisture measurements (top, middle, and bottom) were taken of each sample.

APPENDIX IV

Triaxial Test Results

Graphical Presentation of the A-Factors

TRIAXIAL TEST RESULTS

Test No. 1, Series 1 Drill Hole Sta. 14 + 10 Sample Depth 24'

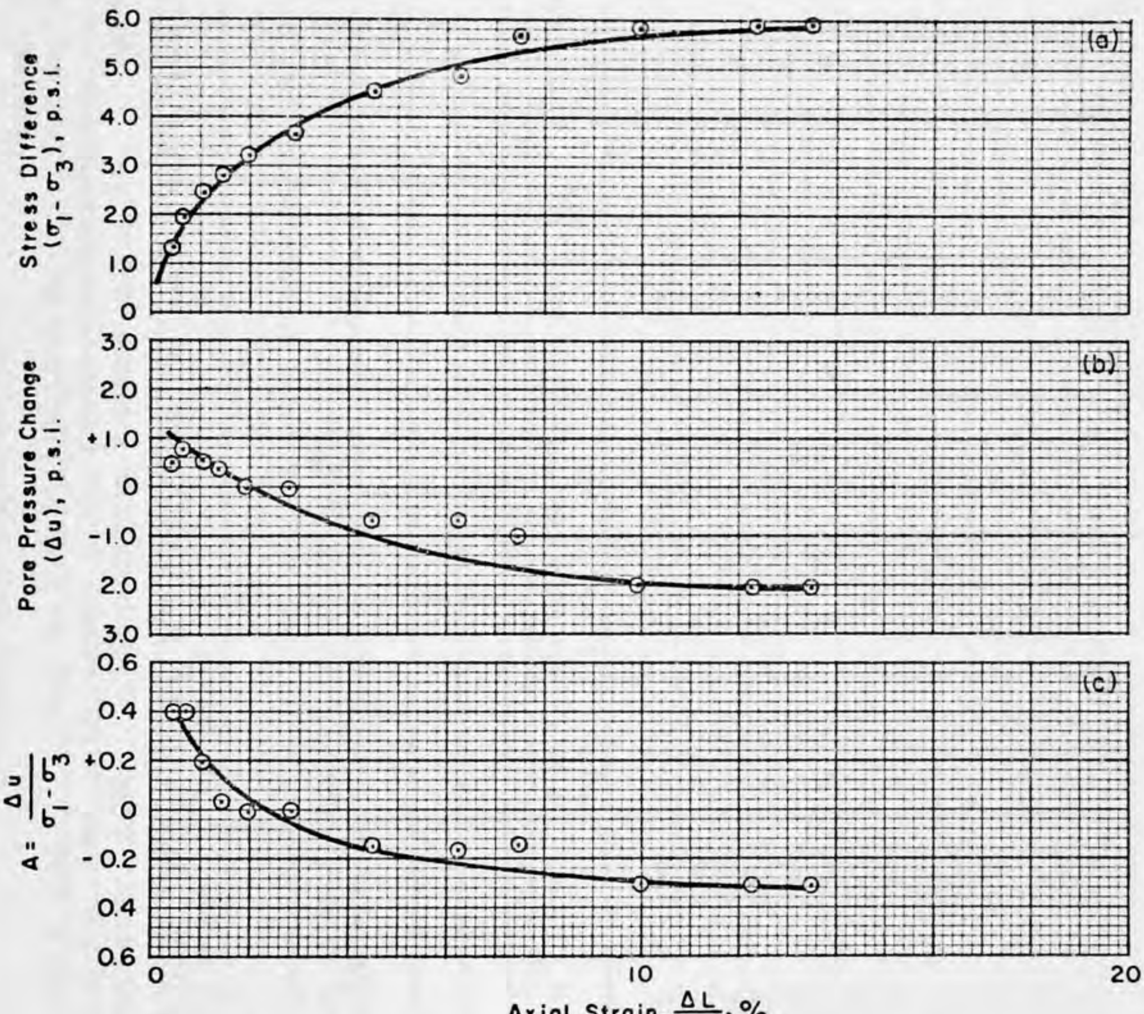

Fig. 29 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta \sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 & UPRR Proj. No. I-15-7(19)315 File No. ______ Test No. 1 Date September 10, 19

Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density 17 Dry Density 88

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 7.2 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle		Moisture content after test was not taken because sample was consolidated						
Bottom		for extracting water for chemical analysis.						
Before Test	T = 312	90.0	74.2	15.8	24.8	49.4	32.0	

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.063								6.0			
20"	.0103	.067	0.084	.9992	4.433	2.70	0.61	7.81		6.0		0.0	
40"	.01045	.069	0.126	.9987	4.437	4.05	0.91	8.11		6.25		0.25	.275
1.5	.0106	.0745	0.242	.9976	4.441	5.40	1.22	8.42		6.5		0.50	.410
3.0	.01075	.078	0.315	.9969	4.444	6.75	1.52	8.72		6.5		0.50	.329
5.0	.0108	.082	0.400	.9960	4.448	7.20	1.62	8.82		6.5		0.50	.309
10.0	.010975	.094	0.652	.9935	4.459	8.775	1.97	9.17		6.75		0.75	.381
15.0	.0111	.104	0.863	.9914	4.468	9.90	2.22	9.42		6.75		0.75	.338
20.0	.01125	.117	1.136	.9886	4.481	11.25	2.51	9.71		6.5		0.50	.199
30.0	.0114	.138	1.578	.9842	4.501	12.60	2.80	10.00		6.25		0.25	.089
40.0	.0116	.158	2.000	.9800	4.520	14.40	3.19	10.39		6.0		0.0	
50.0	.0117	.178	2.421	.9758	4.540	15.30	3.37	10.57		6.0		0.0	
60.0	.011825	.197	2.821	.9718	4.559	16.43	3.60	10.80		6.0		0.0	
80.0	.0121	.237	3.663	.9634	4.597	18.90	4.11	11.31		5.75		0.25	.061
100.0	.0123	.278	4.526	.9547	4.640	20.70	4.46	11.66		5.25		0.75	.168

Remarks ______ AASHO = A-6(9) Tested By ______

Per Cent Consolidated = 0

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description Gray silty clay with fine sand lenses and black organic spots

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 & UPRR Proj. No. I-15-7(19)315 File No. ______ Test No. 1 Date September 10, 19
Drill Hole 11 Depth 24.0" Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 7.2 PSI Par. B ____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi														$\Sigma\Delta P=$
Pore Pressure Increment psi														$\Sigma\Delta U=$
Elapsed Time, min-sec														

Elapsed Time min.	Prov. Ring 0.0001 in.	Length-ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
120.0	.0125	.315	5.305	.9470	4.678	22.500	4.81	12.01		5.25		0.75	.156
140.0	$.0126^{5}$	.357	6.189	.9381	4.722	23.850	5.05	12.25		5.00		1.00	.198
170.0	$.0130^{5}$	.420	7.515	.9249	4.790	27.450	5.73	12.93		5.00		1.00	.175
200.0	$.0131^{5}$	$.481^{75}$	8.815	.9119	4.858	28.350	5.84	13.04		4.00		2.00	.342
230.0	$.0132^{25}$	.540	10.042	.8996	4.924	29.025	5.89	13.09		4.00		2.00	.340
260.0	.0133	.597	11.242	.8876	4.991	29.700	5.95	13.15		4.00		2.00	.336
290.0	$.0133^{5}$	654	12.442	.8756	5.059	30.150	5.96	13.16		4.00		2.00	.335
	.0134	.688	13.074	.8693	5.096	30.600	6.00	13.20		4.00		2.00	.333
318.0	$.0134^{5}$	.702	13.452	8655	5.118	31.050	6.06	13.26		4.00		2.00	.330

Remarks ______ AASHO= ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______
Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 & UPRR Proj. No I-15-7(19)315 File No. ______ Test No. 2 Date September 14, 1
Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.693 Wet Density 118 Dry Density 9
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 38.6 PSI Par. B ______ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		55.9	49.0	6.9	T-300 24.7	24.3		28.4
Middle		58.7	50.6	8.1	T-303 24.8	25.8		31.4
Bottom		54.2	47.4	6.8	T-336 24.9	22.5		30.2
	T-318	75.5	63.2	12.3	24.7	38.5	31.9	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0	10.0						$\Sigma\Delta P =$ 30
Pore Pressure Increment psi	3.0	3.0	2.5	2.5	3.0	5.0	10.0						$\Sigma\Delta U =$ 29
Elapsed Time, min-sec	Inst.	Inst.	10 min.	10 min.	Inst.	Inst.	Inst.						

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								32.00			
20"	$.0102^{5}$	.101	0.021	.9998	4.431	2.25	0.508	39.108		32.00			
1.0	$.0106^{5}$	.102	0.042	.9996	4.432	6.75	1.523	40.123		32.25	0.25		0.164
2.0	.0112	.104	0.085	.9992	4.434	10.80	2.436	41.036		35.00	3.00		1.232
4.0	$.0122^{5}$	.108	0.170	.9983	4.438	20.25	4.563	43.163		37.00	5.00		1.096
8.0	.0137	.116	0.340	.9966	4.445	33.30	7.492	46.092		41.00	9.00		1.201
10.0	.0142	$.119^{5}$	0.415	.9959	4.448	37.80	8.498	47.098		41.25	9.25		1.088
15.0	$.0152^{9}$	.127	0.575	.9943	4.455	47.61	10.687	49.287		43.75	11.75		1.099
20.0	$.0161^{5}$	$.133^{5}$	0.713	.9929	4.462	55.35	12.405	51.005		45.75	13.75		1.108
30.0	$.0175^{5}$	$.147^{5}$	1.012	.9899	4.475	67.95	15.184	53.784		49.50	17.50		1.153
40.0	.0185	$.159^{8}$	1.274	.9873	4.487	76.50	17.049	55.649		50.75	18.75		1.100
50.0	.0191	.169	1.470	.9853	4.496	81.90	18.216	56.816		52.00	20.00		1.098
60.0	$.0200^{5}$	.183	1.768	.9823	4.510	90.45	20.055	58.655		53.25	21.25		1.059
90.0	.0211	.221	2.578	.9742	4.547	99.90	21.971	60.571		54.00	22.00		1.001
120.0	.0221	.267	3.558	.9644	4.594	108.90	23.705	62.305		55.75	23.75		1.002

Remarks ______ AASHO = A-6(9) Tested By ______

Per Cent Consolidated = 92.2

Saturated At ______ Drained 17.9 cc cc's Change in Length Dial .096 − 0.039 = 0.057

Change in Weight 654.4 − 639.3 = 15.1 Consolidation Time 14:40 Hrs.

Soil Description Gray to greenish gray varved clay with black organic spots throughout

117

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 & UPRR Proj. No I-15-7(19)315 File No. ___ Test No. 2 Date September 14, 197[illegible]
Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.693 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 38.6 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔ U =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
150.0	.0230	.355	5.433	.9457	4.684	117.000	24.979	63.579		56.25		24.25	0.971
180.0	$.0230^{5}$	.390	6.179	.9382	4.722	117.450	24.873	63.473		56.25		24.25	0.975
210.0	.0232	.457	7.607	.9239	4.795	118.800	24.776	63.376		56.25		24.25	0.979
240.0	$.0233^{75}$	.524	9.034	.9097	4.870	120.375	24.718	63.318		56.00		24.00	0.971
270.0	$.0235^{5}$	.590	10.441	.8956	4.946	121.950	24.656	63.256		56.00		24.00	0.973
300.0	.0237	.656	11.847	.8815	5.025	123.300	24.537	63.137		55.75		23.75	0.968
335.0	$.0237^{5}$	.722	13.253	.8675	5.107	123.750	24.231	62.831		56.00		24.00	0.990
365.0	$.0240^{5}$	.798	14.873	.8513	5.204	126.450	24.299	62.889		56.00		24.00	0.988
395.0	$.0240^{75}$	.847	15.917	.8408	5.269	126.675	24.042	62.642		56.00		24.00	0.988
425.0	$.0240^{75}$	.878	16.577	.8342	5.310	126.675	23.856	62.456		56.00		24.00	1.006
455.0	$.0240^{75}$	.918	17.430	.8257	5.365	126.675	23.611	62.211		56.00		24.00	1.016
485.0	$.0240^{75}$	.962	18.367	.8163	5.427	126.675	23.342	61.942		56.00		24.00	1.028

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ - ___ = ___
Change in Weight ___ - ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 and UPRR Proj. No I-15-7(19)315 File No. ___ Test No. 3 Date September 17, 1

Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.735 Wet Density 118 Dry Density 8

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 38.6 PSI Par. B ___ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		55.4	47.9	7.5	T-333 24.8	23.1		32.5
Middle		59.3	51.0	8.3	T-308 24.7	26.3		31.6
Bottom		64.6	55.4	9.2	T-322 24.6	30.8		29.9
	T-214	110.5	89.5	21.0	24.9	64.6	32.3	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0100	.050								36.00			
20"	.0102	.0507^{5}	0.005	.9999	4.430	1.800	0.406	39.006		36.75		0.75	1.847
1.0	.0104^{5}	.052	0.042	.9996	4.431	4.050	0.914	39.514		36.75		0.75	0.821
2.0	.0107^{75}	.053	0.063	.9994	4.433	6.975	1.573	40.173		37.00		1.00	0.636
3.0	.011175	.055	0..05	.9990	4.434	10.575	2.385	40.985		37.75		1.75	0.734
5.0	.0117	.058	0.168	.9983	4.438	15.300	3.447	42.047		38.25		2.25	0.653
8.0	.0124	.062^{5}	0.263	.9974	4.422	21.600	4.863	43.463		38.75		2.75	0.565
10.0	.0128	.066	0.337	.9966	4.445	25.200	5.669	44.269		39.75		3.75	0.661
15.0	.0138^{75}	.075	0.527	.9947	4.454	34.875	7.830	46.430		41.00		5.00	0.639
20.0	.0149	.083^{5}	0.707	.9929	4.462	44.100	9.883	48.483		42.00		6.00	0.607
30.0	.0165	.102	1.098	.9890	4.479	58.500	13.061	51.661		44.00		8.00	0.613
40.0	.0175	.121	1.449	.9850	4.497	67.500	15.010	53.610		45.00		9.00	0.600
50.0	.0183	.140	1.900	.9810	4.516	74.700	16.541	55.141		45.75		9.75	0.589
60.0	.0188	.161	2.344	.9766	4.536	79.200	17.460	56.060		46.25		10.25	0.587
90.0	.0197^{5}	.220	3.590	.9641	4.595	87.750	19.097	57.697		46.75		10.75	0.563

Remarks ___ AASHO = A-6(10) Tested By ___

Per Cent Consolidated = 58.5

Saturated At ___ Drained 13 cc's Change in Length Dial .043 - .028 = .005

Change in Weight 653.7 - 643.1 = 10.6 Consolidation Time 2 Hrs.

Soil Description Gray to greenish gray varved clay with fine sand lenses and organic spots

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 1

Project Name Pages Lane to Lagoon Proj. No. I-15-7(19)315 File No. ___ Test No. 3 Date September 17, 1
Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 38.6 PSI Par. B ___ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
120.0	.202	.289	5.005	.9500	4.663	91.800	19.689	58.289		46.^{75}		10.75	0.546
150.0	.203^{5}	.350	6.335	.9367	4.729	93.150	19.698	58.298		47.0		11.00	0.558
180.0	.204	.409	7.581	.9242	4.793	93.600	19.528	58.128		47.0		11.00	0.563
205.0	.205	.456	8.574	.9143	4.845	94.500	19.505	58.105		47.0		11.00	0.564
235.0	.208	.513	9.778	.9022	4.910	97.200	19.796	58.396		47.0		11.00	0.556
265.0	.208^{5}	.561	10.791	.8921	4.966	97.650	19.664	58.264		47.0		11.00	0.559
295.0	.209^{5}	.625	12.100	.8790	5.040	98.550	19.550	58.150		47.0		11.00	0.563
325.0	.209	.660	12.882	.8712	5.085	98.100	19.292	57.892		47.0		11.00	0.570
355.0	.209	.720	14.149	.8585	5.160	98.100	19.012	57.612		47.0		11.00	0.579
385.0													
415.0	.207^{5}	.862	17.148	.8285	5.347	96.750	18.094	56.694		47.0		11.00	0.663
445.0	.207^{5}	.905	18.057	.8194	5.406	96.750	17.897	56.497		47.0		11.00	0.615

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 & UPRR Proj. No. I-15-7(19)315 File No. ______ Test No. 4 Date Sept. 21, 1970

Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.722 Wet Density 119 Dry Density 9

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 38.6 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location		Container Number		Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.		Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	1.8	1.6	1.4	62.1	53.1	9.0	T-323	24.8	28.3		31.8
Middle	1.5	.95	1.2	62.0	53.2	8.8	T-320	24.6	28.6		30.8
Bottom	1.4	1.4	1.4	59.2	51.2	8.0	T-325	24.8	26.4		30.3
		T-307		51.7	45.5	6.2		24.9	20.6	30	

Back Pressure Increment psi	4.0	2.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	4.0	2.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
.00	.0100	.050								47.00			
.20	.0103^{5}	.050^{75}								47.25			
1.0	.0106	.052	0.042	.9996	4.432	5.400	1.215	39.815		47.75	0.75		0.617
2.0	.0109^{5}	.054	0.080	.9992	4.434	8.550	1.928	40.528		48.50	1.50		0.778
4.0	.0116	.058^{25}	0.174	.9983	4.438	14.400	3.245	41.845		49.00	2.00		0.616
6.0	.0120^{5}	.060^{5}	0.222	.9978	4.440	18.450	4.155	42.755		49.25	2.25		0.542
8.0	.0124	066	0.338	.9966	4.445	21.600	4.859	43.459		49.25	2.25		0.463
10.0	.0126	.067^{75}	0.370	.9963	4.446	23.400	5.263	43.863		49.50	2.50		0.475
15.0	.0131	.075	0.529	.9947	4.454	27.900	6.264	44.864		49.75	2.75		0.439
20.0	.0136	.081^{25}	0.661	.9934	4.459	32.400	7.266	45.886		50.00	3.00		0.413
30.0	.0141^{75}	.092	0.889	.9911	4.470	37.575	8.406	47.006		50.00	3.00		0.357
60.0	.0156	116	1.397	.9860	4.493	50.400	11.217	49.817		50.75	3.75		0.334
90.0	.0165^{5}	.137	1.842	.9816	4.513	58.950	13.062	51.662		51.00	4.00		0.306
120.0	.0170^{5}	.151	2.138	.9786	4.527	63.450	14.016	52.616		51.50	4.50		0.321
150.0	.0182	.192	3.007	.9699	4.567	73.800	16.159	54.759		50.00	3.00		0.186

Remarks ______ AASHO = A-6(11) Tested By ______

Per Cent Consolidated = 30.1

Saturated At ______ Drained 13.0 cc's Change in Length Dial .056 - .028 = .028

Change in Weight 659.2 - 653.3 = 5.9 Consolidation Time 3 Hrs.

Soil Description Greenish gray silty clay with fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 1

Project Name Parrish Lane Over I-15 & UPRR Proj. No I-15-7(19)315 File No. ___ Test No. 4 Date Sept. 21, 1970
Drill Hole 11 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 38.6 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	i − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
180.0	.0187	.247	4.171	.9583	4.623	78.300	16.937	55.537		50.00		3.00	0.177
210.0	.0189	.303	5.357	.9464	4.681	80.100	17.112	55.712		49.00		2.00	0.117
240.0	.0190	.357	6.501	.9350	4.738	81.000	17.096	55.696		49.00		2.00	0.117
270.0	.0191^{5}	.415	7.729	.9227	4.801	82.350	17.153	55.753		48.75		1.75	0.102
300.0	.0192	.473	8.958	.9104	4.866	82.800	17.016	55.616		48.50		1.50	0.088
330.0	.0193	.533^{5}	10.239	.8976	4.935	83.700	16.960	55.560		48.50		1.50	0.088
360.0	.0194	.589	11.414	.8859	5.001	84.600	16.917	55.517		48.50		1.50	0.089
390.0	.0194	.645	12.600	.8740	5.069	84.600	16.690	55.290		48.00		1.00	0.060
420.0	.0194^{5}	.697	13.701	.8630	5.133	85.050	16.569	55.169		48.50		1.50	0.091
450.0	.0195	.750	14.800	.8520	5.200	85.500	16.440	55.040		48.50		1.50	0.091
480.0	.0195	.794	15.756	.8424	5.259	85.500	16.258	54.858		48.50		1.50	0.092

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

TRIAXIAL TEST RESULTS

Test No. 1, Series 2 Drill Hole Sta. 12 + 10 Sample Depth 17'

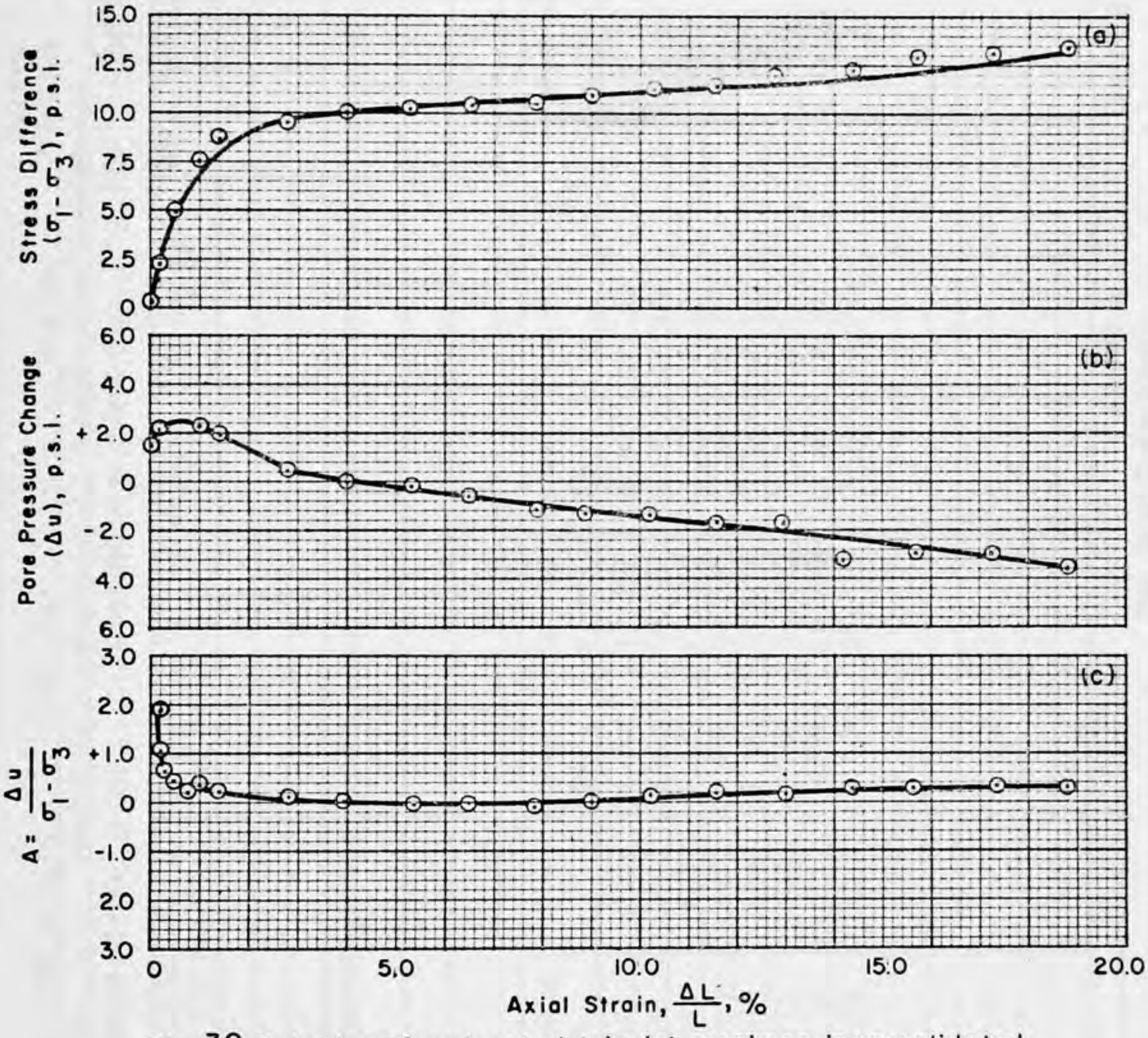

Fig. 30 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta \sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ______ File No. ______ Test No. 1 Date Sept. 23, 1970
Drill Hole 9 Depth 17.0' Dia. 2.0 Area 3.14 Length 4.0 Length After Consolidation ______ Wet Density ______ Dry Density ______
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure ______ PSI Par. B ______ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
210.0	.0141^{5}	.407^{5}	8.952	.9105	3.449	37.350	10.829	17.729		40.50		1.25	0.115
240.0	.0143	.457	10.191	.8981	3.496	38.700	11.070	17.970		40.50		1.25	0.113
270.0	.0164	.513	11.593	.8841	3.552	41.400	11.655	18.555		40.00		1.75	0.150
300.0	.0147^{5}	.568^{5}	12.983	.8702	3.608	42.750	11.849	18.749		40.00		1.75	0.148
330.0	.0150	.625	14.398	.8560	3.668	45.000	12.268	19.168		38.50		3.25	0.265
360.0	.0152	.680	15.775	.8423	3.728	46.800	12.554	19.454		38.75		3.00	0.239
390.0	.0154	.740	17.278	.8272	3.796	48.600	12.803	19.703		38.75		3.00	0.234
420.0	.0156^{5}	.802	18.850	.8117	3.868	50.850	13.146	20.046		38.25		3.50	0.266

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ________ File No. ______ Test No. 1 Date Sept. 23, 1970

Drill Hole 9 Depth 17.0' Dia. 2.0 Area 3.14 Length 4.0 Length After Consolidation 3.9935 Wet Density 127 Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 6.9 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	After test moisture was not taken because water was drained for soluble salts.							
Middle								
Bottom								
	T-313	104.8	87.4	17.4	24.8	62.6	27.8	

Back Pressure Increment psi	3.0	4.0	2.0	3.0	3.0	5.0	10.0	10.0					$\Sigma\Delta P$ = 40
Pore Pressure Increment psi	3.0	4.0	2.0	2.75	3.0	5.25	9.5	10.0					$\Sigma\Delta U$ = 39.5
Elapsed Time, min-sec	2 min.	4.5 min.	1 min.	10 min.	2 min.	1 min.	10 min	Inst.					

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.00	.0100	.050											
0.20	.0101	.051	0.025	.9998	3.141	0.90	0.287	7.187		43.25		1.50	5.227
0.40	.0102	.052	0.050	.9995	3.142	1.80	0.573	7.473		43.25		1.50	2.618
1.00	.0103	.053	0.075	.9993	3.142	2.70	0.859	7.759		43.25		1.50	1.746
3.00	.0108	.058	0.200	.9980	3.146	7.20	2.289	9.189		44.00		2.25	0.983
5.00	.0112	.063	0.325	.9968	3.150	10.80	3.429	10.329		44.00		2.25	0.656
8.00	$.0116^5$	.070	0.500	.9950	3.156	14.85	4.705	11.605		44.00		2.25	0.478
15.00	.0124	.082	0.801	.9920	3.165	21.60	6.825	13.725		44.00		2.25	0.330
20.00	$.0126^5$	.090	1.001	.9900	3.172	23.85	7.519	14.419		44.00		2.25	0.299
30.00	.0130	$.107^5$	1.439	.9856	3.186	27.00	8.475	15.375		43.50		1.75	0.206
60.00	.0132	.162	2.804	.9720	3.230	28.80	8.916	15.816		42.25		0.50	0.056
90.00	.0135	.209	3.981	.9602	3.270	31.50	9.633	16.533		42.00		0.25	0.026
120.00	.0137	.263	5.333	.9467	3.317	33.30	10.039	16.939		41.50		0.25	0.025
150.00	$.0138^5$	$.312^5$	6.573	.9343	3.361	34.65	10.309	17.209		41.00		0.75	0.073
180.00	.0140	.364	7.862	.9214	3.418	36.00	10.563	17.463		40.50		1.25	0.118

Remarks ____________ AASHO = A-7-6(13) Tested By ____________

Per Cent Consolidated = 67.4

Saturated At 39.5 P.S.T. Drained 5.8 cc's Change in Length Dial $.041^5$ − .035 = $.006^5$

Change in Weight 418.2 − 415.3 = 2.9 Consolidation Time 43.4 Hrs.

Soil Description Gray silty clay with rust and organic spots throughout sample.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ______ File No. ______ Test No. 2 Date November 16, 19

Drill Hole 15 Depth 19.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.585 Wet Density 113 Dry Density ______

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 43.9 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		64.1	54.6	9.5	T-309 24.6	30.0		31.7
Middle		78.2	65.3	12.9	T-318 24.7	40.6		31.8
Bottom		66.1	55.6	10.5	T-319 24.7	30.9		34.0
	T-334	85.3	68.3	17.0	25.0	43.3	39.3	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.200								36.0			
20"	.0101	.201								38.0			
2.0	.0111	.206	0.1300	.9987	4.436	9.900	2.232	46.132		39.5		3.5	1.568
5.0	.0122	.213	0.9972	.9972	4.442	19.800	4.457	48.357		41.75		3.75	1.290
10.0	.0133^{5}	.228	0.6100	.9939	4.457	30.150	6.765	50.665		44.00		8.00	1.183
15.0	.0143^{5}	.244	0.9590	.9904	4.473	39.150	8.753	52.653		46.50		10.50	1.200
20.0	.0151	.257^{5}	1.2540	.9875	4.486	39.150	10.232	54.132		48.75		12.75	1.246
30.0	.0158	.281	1.7660	.9823	4.510	45.900	11.574	55.474		51.00		15.00	1.296
40.0	.0162	.308	2.3550	.9765	4.537	52.500	12.299	56.199		52.25		16.25	1.321
50.0	.0163^{75}	.333	2.9000	.9710	4.562	55.800	12.577	56.477		53.50		17.50	1.391
60.0	.0164	.353	3.3360	.9666	4.583	57.375	12.568	56.468		54.00		18.00	1.432
70.0	.0165	.372	3.7510	.9625	4.603	57.600	12.709	56.609		54.25		18.25	1.436
80.0	.0166	.392	4.1870	.9581	4.624	58.500	12.846	56.746		54.50		18.50	1.479
90.0	.0166	.426	4.9290	.9507	4.660	59.400	12.747	56.647		55.00		19.00	1.491
120.0	.0167	.484	6.1940	.9381	4.722	60.300	12.770	56.670		55.00		19.00	1.488

Remarks ______ AASHO = A-6(12) Tested By ______

Per Cent Consolidated = 63.6

Saturated At ______ Drained 33.7 cc's Change in Length Dial .190 − .025 = .165

Change in Weight 626.3 − 596.0 = 30.3 Consolidation Time 4.7 Hrs.

Soil Description Gray silty clay with alternating fine sant lenses.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. _____ File No. _____ Test No. 2 Date November 16, 19
Drill Hole 15 Depth 19.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation _____ Wet Density _____ Dry Density _____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 43.9 PSI Par. B _____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P =$
Pore Pressure Increment psi													$\Sigma\Delta U =$
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
150.0	.0168	.551	7.655	.9235	4.797	61.200	12.758	56.658		55.00		19.00	1.489
180.0	.0169	.612	8.985	.9102	4.867	62.100	12.759	56.659		55.00		19.00	1.489
240.0	.0171	.732	11.603	.8840	5.011	63.900	12.752	56.652		55.00		19.00	1.490
270.0	.0171	.789	12.846	.8715	5.083	63.900	12.571	56.471		55.75		19.75	1.571
300.0	.0171	.848	14.133	.8587	5.159	63.900	12.386	56.286		55.75		19.75	1.595
330.0	.0171[5]	.906	15.398	.8460	5.236	64.350	12.290	56.199		55.75		19.75	1.609

Remarks _____ AASHO = _____ Tested By _____
Per Cent Consolidated = _____
Saturated At _____ Drained _____ cc's Change in Length Dial _____ - _____ = _____
Change in Weight _____ - _____ = _____ Consolidation Time _____ Hrs.
Soil Description _____

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(19)315 File No. ______ Test No. 3 Date Sept. 30, 1970
Drill Hole 9 Depth 17.0' Dia. 2.0 Area 3.14 Length 4.0 Length After Consolidation 3.955 Wet Density 121 Dry Density ______
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 43.9 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		45.78	41.2	4.58	T-316 24.8	16.4		27.9
Middle		49.86	44.5	5.36	T-319 24.7	19.8		27.1
Bottom		55.09	48.8	6.29	T-331 24.9	23.9		26.3
	T-327	66.2	56.1	10.1	24.9	31.2	32.4	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0	10.0	10.0						ΣΔP = 40
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0	10.0	10.0						ΣΔU = 40
Elapsed Time, min-sec														

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								60.00			
20	.0101	.101	0.025	.9998	3.141	0.900	.287	44.187		63.25		3.25	11.324
1.0	.0107	.107	0.176	.9982	3.146	6.300	2.003	45.903		65.00		5.00	2.496
2.0	.0111	.109	0.227	.9977	3.147	9.900	3.146	47.046		65.50		5.50	1.748
5.0	.0116	.113	0.328	.9967	3.150	14.400	4.571	48.471		66.25		6.25	1.367
10.0	.0126	.119	0.480	.9952	3.155	23.400	7.417	51.317		67.00		7.00	0.944
15.0	.0138	.124	0.606	.9939	3.159	34.200	10.826	54.726		68.00		8.00	0.739
20.0	.0147	.132	0.809	.9919	3.166	42.300	13.361	57.261		69.00		9.00	0.674
30.0	.0163	.145	1.137	.9886	3.176	56.700	17.853	61.752		69.50		9.50	0.532
60.0	.0198	.186	2.174	.9783	3.210	88.200	27.477	71.377		68.00		8.00	0.291
90.0	.0213	.256	3.944	.9606	3.269	101.700	31.110	75.010		70.00		10.00	0.321
120.0	.0215 75	.300	5.056	.9494	3.307	104.175	31.501	75.401		69.00		9.00	0.286
150.0	.0217	.346	6.219	.9378	3.348	105.300	31.452	75.352		68.00		8.00	0.254
180.0	.0217	.384	7.180	.9282	3.383	105.300	31.126	75.026		68.00		8.00	0.259
210.0	.0218	.433	8.419	.9158	3.429	106.200	30.971	7 .871		68.00		8.00	0.258

Remarks ______ AASHO = A-7-6(11) Tested By ______
Per Cent Consolidated = 54.4

Saturated At ______ Drained 22.7 cc's Change in Length Dial .081 − .036 = .045
Change in Weight 399.2 − 390.0 = 9.2 Consolidation Time 18.7 Hrs.
Soil Description Brown silty clay with alternating fine sand layers, rust and organic spots

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ______ File No. ______ Test No. 3 Date Sept. 30, 1970

Drill Hole 9 Depth 17.0' Dia. 2.0 Area 3.14 Length 4.0 Length After Consolidation ______ Wet Density ______ Dry Density ______

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure ______ PSI Par. B ______ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P$ =
Pore Pressure Increment psi													$\Sigma\Delta U$ =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
240.0	.0219	.490	9.860	.9014	3.483	107.10	30.749	74.649		67.50		7.50	0.244
270.0	.0219^{5}	.546	11.276	.9872	3.539	107.55	30.390	74.290		67.50		7.50	0.247
300.0	.0220^{5}	.597	12.566	.8743	3.591	108.45	30.201	74.101		67.50		7.50	0.248
320.0	.0221	.650	13.906	.8609	3.647	108.90	29.860	73.760		67.50		7.50	0.251
335.0	.0221	.670	14.412	.8559	3.669	108.90	29.681	73.581		67.00		7.00	0.236

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______

Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ______ File No. ______ Test No. 4 Date October 2, 1970
Drill Hole 15 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.648 Wet Density 140 Dry Density 1[illegible]
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 43.9 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	T-323	66.3	56.4	9.9	24.8	31.6		31.3
Middle	T-311	66.6	56.7	9.9	24.7	32.0		30.9
Bottom	T-325	53.4	46.6	6.8	24.8	21.8		31.2

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 In.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.125								21.00			
20	.0104	.126	0.021	.9998	4.431	3.600	0.812	44.712		21.25		0.25	.308
1.0	.0110	.128	0.064	.9994	4.433	9.000	2.030	45.930		22.00		1.00	.493
3.0	.0124	.133	0.172	.9983	4.438	21.600	4.867	48.767		24.50		3.50	.719
6.0	.0140	.139	0.301	.9970	4.443	36.000	8.103	52.003		28.00		7.00	.864
10.0	.0159	.147	0.473	.9953	4.451	53.100	11.930	55.830		32.00		11.00	.922
15.0	.0174	.155	0.645	.9936	4.459	66.600	14.936	58.836		34.75		13.75	.921
20.0	.0185	.162	0.796	.9920	4.466	76.500	17.129	61.029		37.75		16.75	.978
27.0	.0196	.172	1.011	.9899	4.475	86.400	19.307	63.207		39.00		18.00	.932
37.0	.0206	.184	1.269	.9873	4.487	95.400	21.261	65.161		41.00		20.00	.941
67.0	.0226	.221	2.065	.9794	4.523	113.400	25.072	68.972		45.00		24.00	.957
97.0	.0238	.261	2.925	.9708	4.563	124.200	27.219	71.119		46.00		25.00	.918
127.0	.0244	.305	3.872	.9613	4.608	129.600	28.125	72.025		46.00		25.00	.889
157.0	.0246[5]	.357	4.991	.9501	4.663	131.850	28.276	72.176		47.00		26.00	.919
217.0	.0246[5]	.453	7.056	.9294	4.767	131.850	27.659	71.559		47.00		26.00	.940

Remarks ______ AASHO = A-7-6(12) Tested By ______
Per Cent Consolidated = 97.7
Saturated At ______ Drained 17.4 cc's Change in Length Dial .125 − .023 = .102
Change in Weight ______ − ______ = ______ Consolidation Time 16.5 Hrs.
Soil Description Greenish gray mottled silty clay

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ______ File No. ______ Test No. 4 Date October 2, 1970
Drill Hole 15 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.65 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure ______ PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 In.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
247.0	.0246	.501	8.089	.9191	4.820	131.400	27.261	71.161		47.00		26.00	.954
277.0	.0246	.559	9.337	.9066	4.886	131.400	26.893	70.793		47.00		26.00	.967
307.0	.0246	.615	10.542	.8946	4.952	131.400	26.535	70.435		47.00		26.00	.980
337.0	.0246	.664	11.596	.8840	5.011	131.400	26.222	70.122		47.00		26.00	.992
367.0	.0246	.712	12.629	.8737	5.070	131.400	25.917	69.817		47.00		26.00	1.003
397.0	.0246	.758	13.618	.8638	5.129	131.400	25.619	69.519		47.00		26.00	1.015
427.0	.0246	.807	14.672	.8533	5.192	131.400	25.308	69.208		47.00		26.00	1.027
447.0	.0246	.836	15.296	.8470	5.230	131.400	25.124	69.024		46.50		25.50	1.015

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(19)315 File No. ______ Test No. 5 Date October 8, 1970
Drill Hole 15 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.70 Wet Density 118 Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 43.9 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		64.9	55.1	9.8	T-332 24.8	30.3		32.3
Middle		69.4	58.7	10.7	T-318 24.7	34.0		31.5
Bottom		57.2	49.7	7.5	T-314 24.9	24.8		30.2
	I-322	67.0	56.8	10.2	24.6	32.2	31.7	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0	10.0							ΣΔP= 30.0
Pore Pressure Increment psi	3.0	3.0	3.0	2.75	3.0	5.0	10.0							ΣΔU =30.0
Elapsed Time, min-sec	Inst.	Inst.	1.0min.	2.30min.	2.30min.	Inst	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0100	.050								56.00			
20	.0104	.051	0.021	.9998	4.431	3.60	0.812	44.712		56.75		0.75	0.924
1.0	.0108	.053	0.063	.9994	4.433	7.20	1.624	45.524		57.50		1.50	0.924
3.0	$.0116^5$	.057	0.148	.9985	4.437	14.85	3.347	47.247		58.50		2.50	0.747
5.0	$.0122^5$	.062	0.255	.9975	4.441	20.25	4.560	48.460		59.50		3.50	0.768
7.0	.0128	.066	0.340	.9966	4.445	25.20	5.669	49.569		60.00		4.00	0.706
10.0	.0134	.072	0.468	9953	4.451	30.60	6.875	50.725		60.00		5.00	0.727
15.0	.0141	.081	0.659	.9934	4.459	36.90	8.275	52.175		62.00		6.00	0.725
20.0	.0147	.089	0.829	.9917	4.467	42.30	9.469	53.369		62.75		6.75	0.713
30.0	.0158	.107	1.212	.9879	4.484	52.20	11.641	55.541		64.00		8.00	0.687
60.0	.0176	.159	2.319	.9768	4.535	68.40	15.083	58.983		65.25		8.25	0.547
90.0	.0185	222	3.659	.9634	4.598	76.50	16.638	60.538		65.25		8.25	0.496
120.0	.0190	281	4.914	.9509	4.659	81.00	17.386	61.286		65.00		8.00	0.460
150.0	$.0192^5$	.337	6.116	.9389	4.718	83.25	17.645	61.545		65.00		8.00	0.453
180.0	$.0194^5$	.392	7.276	.9272	4.778	85.05	17.800	61.700		65.00		8.00	0.449

Remarks ______ AASHO = A-6(10) Tested By ______
Per Cent Consolidated = 40.8
Saturated At 30.0 p.s.i. Drained 11.5 cc's Change in Length Dial .065 - .015 = .050
Change in Weight 652.6 - 643.0 = 9.6 Consolidation Time 2.2 Hrs.
Soil Description Greenish gray mottled silty clay with alternating fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 2

Project Name Parrish Lane over UPRR & I-15 Proj. No. ______ File No. ______ Test No. 5 Date October 8, 197
Drill Hole 15 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.70 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 43.9 PSI Par. B ____ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
240.0	.0196	.494	9.446	.9055	4.892	86.400	17.661	61.561		64.00		8.00	.453
270.0	.0197	.548	10.595	.8941	4.955	87.300	17.619	61.519		64.00		8.00	.454
300.0	.0198	.607	11.851	.8815	5.026	88.200	17.549	61.449		64.50		8.50	.484
330.0	.0198[5]	.656	12.893	.8711	5.086	88.650	17.430	61.330		64.50		8.50	.488
360.0	.0198[5]	.703	13.893	.8611	5.145	88.650	17.230	61.130		64.50		8.50	.493
390.0	.0199	.765	15.212	.8479	5.225	89.100	17.053	60.953		63.75		7.75	.454

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

TRIAXIAL TEST RESULTS

Test No. 1, Series 3 Drill Hole Sta. 15 + 60 Sample Depth 15'

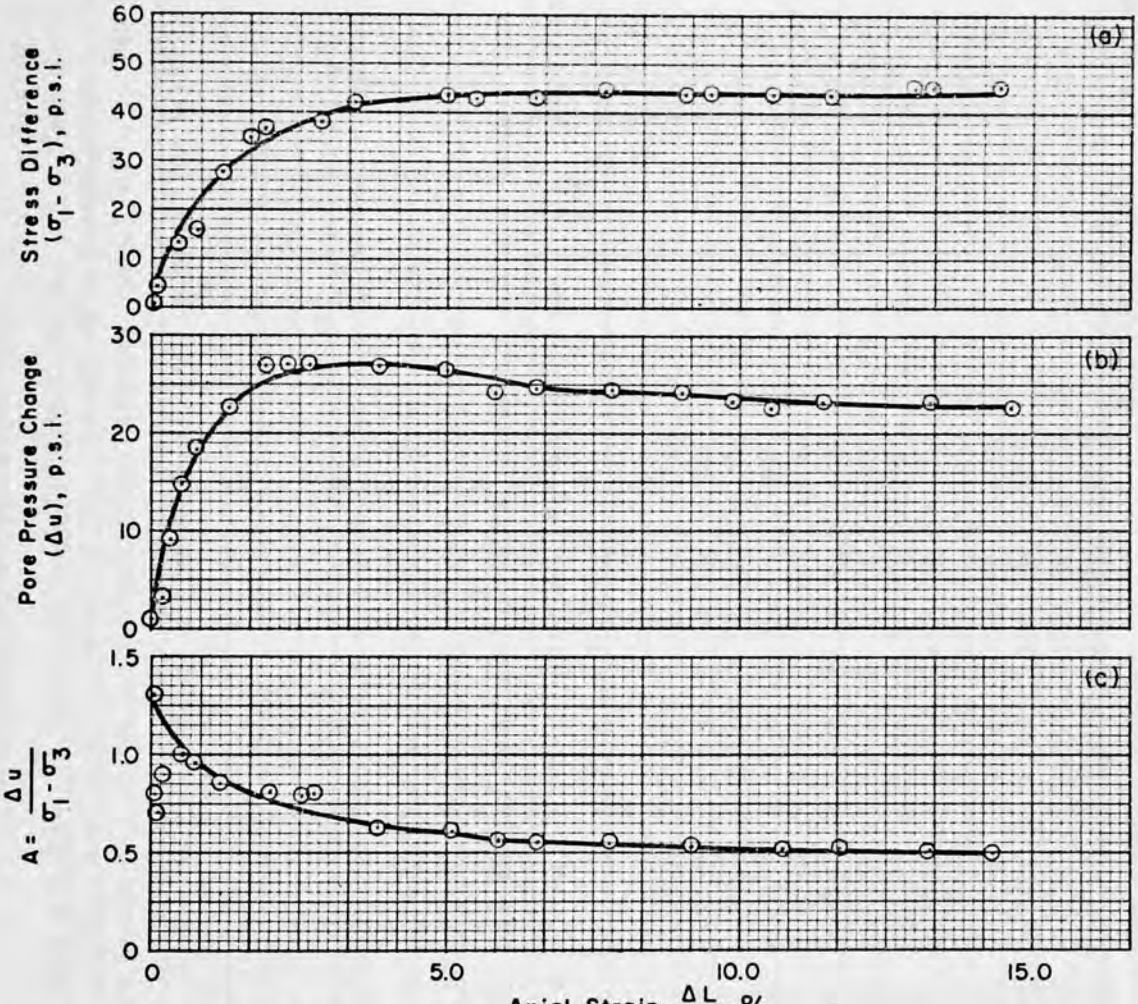

Fig. 31 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 3

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(19)315 File No. ______ Test No. 1 Date October 14, 1970
Drill Hole 12 Depth 15.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.697 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 45.0 PSI Par. B ____ Str. Rate .003 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	2.65 unable to	56.3	49.9	6.4	T-336 24.9	25.0		25.6
Middle	get results	57.3	50.6	6.7	T-312 24.8	25.8		26.0
Bottom 3.25	2.75 3.25	63.7	55.5	8.2	T-329 24.8	30.7		26.7
	T-328	53.2	47.6	5.6	24.7	22.9	24.5	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0	10.0	10.0						ΣΔP = 40
Pore Pressure Increment psi	3.0	2.25	2.75	2.25	2.75	5.0	8.0	10.0						ΣΔU = 36.5
Elapsed Time, min-sec	Inst.	5 min.	8½"	3 min.	1 min.	Inst.	overnite	Inst.						

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								36.50			
20"	.01045	.101	.021	.9998	4.431	4.05	.914			37.75		1.25	1.367
1.0	.0109	.103	.063	.9994	4.433	8.10	1.827			38.00		1.50	.821
3.0	.01235	.106	.127	.9987	4.436	21.15	4.768			40.00		3.50	.734
5.0	.01365	.110	.212	.9979	4.439	32.85	7.400			43.00		6.50	.878
7.0	.0148	.114	.298	.9970	4.443	43.20	9.723			46.00		9.50	.977
10.0	.0162	.121	.447	.9955	4.450	55.80	12.539			49.00		12.50	.997
15.0	.0179	.128	.596	.9940	4.457	71.10	15.952			51.25		14.75	1.057
20.0	.0200	.137	.787	.9921	4.465	90.00	20.156			54.50		18.00	.893
30.0	.0232	.155	1.170	.9883	4.482	118.80	26.506			59.25		22.75	.858
60.0	.0273	.196	1.043	.9796	4.522	155.70	34.432			63.25		26.75	.777
70.0	.0285	.211	2.363	.9764	4.537	165.50	36.698			63.25		26.75	.729
100.0	.0288	.223	2.618	.9736	4.549	169.20	37.195			63.25		26.75	.719
130.0	.0315	.279	3.810	.9619	4.605	193.50	42.040			63.75		26.75	.637
150.0	.0323	.338	5.067	.9493	4.666	200.70	43.013			63.00		26.50	.616

Remarks ______________ AASHO = A-6(10) Tested By ______________

Per Cent Consolidated = 100.0

Saturated At ______________ Drained 13.2 cc's Change in Length Dial .093 − .040 = .053

Change in Weight 680.7 − 673.8 = 6.9 Consolidation Time ______________ Hrs.

Soil Description Grayish brown stiff clay with 1" fine sand layer near top of sample

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(19)315 File No. ______ Test No. 1 Date October 14, 19
Drill Hole 12 Depth 15.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ______ Dry Density ______
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure ______ PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	i − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
180.0	$.0329^5$	.373	5.812	.9419	4.703	206.55	43.919			61.00		24.50	.558
240.0	.0329	.406	6.514	.9349	4.738	206.10	43.499			61.00		24.50	.563
270.0	$.0334^5$	.465	7.770	.9223	4.803	211.05	43.941			60.75		24.25	.552
300.0	.0339	.523	9.005	.9100	4.868	215.10	44.187			60.75		24.00	.543
330.0	.0340	$.564^5$	9.910	.9009	4.917	216.00	43.929			59.75		23.25	.529
360.0	$.0341^5$	.602	10.687	.8931	4.960	217.35	43.821			59.25		22.75	.519
390.0	$.0348^5$	.646	11.624	.8838	5.012	218.61	44.617			59.50		23.00	.527
420.0	.0355	.723	13.263	.8674	5.107	229.50	44.938			59.25		22.75	.506
450.0	.0360	.785	14.583	.8542	5.186	234.00	45.121			59.00		22.50	.499

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Project Name Parrish Lane Over UPRR & I-15 Pages Lane to Lagoon Proj. No. I-15-7(19)315 67-7-F-41 File No. ___ Series 3 Test No. 2 Date October 28, 1970
Drill Hole 13 Depth 15.0' Dia. 2.375 Area 4.43 Length 4.0 Length After Consolidation 3.969 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 45.0 PSI Par. B ___ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		59.9	51.4	8.5	T-318 24.7	26.7		31.8
Middle		68.9	58.8	10.1	T-309 24.6	34.2		29.5
Bottom		50.4	45.0	5.4	T-313 24.8	20.2		26.7
		93.3	77.1	16.2	24.8	52.3	31	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	σ1/σ3	Pore Press u, psi	u in inches of Hg	Δu, psi	A = Δu/(σ1−σ3)
0.0	.0100	.050								36.50			
20"	.0104^5	.051	.025	.9998	4.431	4.05	.914			37.00		0.50	.547
2.0	.0116	.056	.151	.9985	4.438	14.40	3.245			39.00		2.50	.770
5.0	.0125	.061	.277	.9982	4.438	22.50	5.070			39.75		3.25	.641
10.0	.0139^5	.069	.478	.9952	4.451	33.55	7.986			41.00		4.50	.563
15.0	.0151^5	.079	.736	.9926	4.463	46.35	10.385			43.50		7.00	.674
20.0	.0163	.089	.982	.9902	4.474	56.70	12.673			44.75		8.25	.651
31.0	.0182	.113	1.587	.9841	4.452	73.80	16.577			47.25		10.75	.648
60.0	.0201	.171	3.046	.9695	4.569	90.90	19.895			50.00		13.50	.679
120.0	.0217	.288	5.996	.9400	4.713	105.30	22.342			50.00		13.50	.604
180.0	.0223	.400	8.818	.9118	4.859	110.70	22.782			51.00		14.50	.636
210.0	.0226	.454	10.178	.8982	4.932	113.40	22.932			51.00		14.50	.632
240.0	.0228	.514	11.7	.8830	5.017	115.20	22.962			51.00		14.50	.631
270.0	.0229	.574	13.202	.8680	5.104	116.10	22.747			51.00		14.50	.637
300.0	.0230	.637	14.789	.8521	5.199	117.00	22.504			51.00		14.50	.644

Remarks ___ AASHO = A-6(12) Tested By ___
Per Cent Consolidated = 63.3
Saturated At 20 p.s.i. Drained ___ cc's Change in Length Dial .063 − .032 = .031
Change in Weight 550.3 − 537.9 = 12.4 Consolidation Time ___ Hrs.
Soil Description Brownish gray silty clay with alternating fine sand lenses, rust and organic spots

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 3

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date October 30, 197
Drill Hole 13 Depth 15.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.744 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 6.7 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-328	66.8	56.9	9.9	24.7	32.2	30.7	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta P =$ 20
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta U =$ 20
Elapsed Time, min-sec	Inst.	Inst.	1 min. 45 sec	30 sec.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	-.050								21.00			
20"	.0104	.051	.021	.9998	4.431	3.60	.812			21.25		.25	.308
1.0	.0107	$.052^{5}$	.052	.9995	4.432	6.30	1.421			22.00		1.00	.704
3.0	.0113	.061	.231	.9977	4.440	11.70	2.635			23.00		2.00	.759
5.0	.0117	.067	.358	.9964	4.446	15.30	3.441			23.25		2.25	.654
10.0	.0123	.079	.611	.9939	4.457	20.70	4.644			24.00		3.00	.646
15.0	.0128	.090	.843	.9916	4.467	25.20	5.647			24.00		3.00	.332
20.0	.0133	.102	1.096	.9890	4.479	29.70	6.631			24.00		3.00	.452
25.0	.0137	.112	1.306	.9869	4.489	33.30	7.418			24.00		3.00	.404
35.0	$.0144^{75}$	.136	1.812	.9819	4.512	40.28	8.926			23.25		2.25	.252
65.0	.0155	.185	2.845	.9716	4.559	49.50	10.857			22.25		1.25	.115
95.0	.0163	.244	4.089	.9591	4.619	56.70	12.275			21.50		.50	.041
125.0	.0168	.300	5.269	.9431	4.697	61.20	13.030			21.50		.50	.038
155.0	$.0173^{5}$	.365	6.639	.9336	4.745	66.15	13.941			20.50		.50	.036
185.0	.0177	.430	8.010	.9199	4.816	69.30	14.389			20.50		1.00	.069

Remarks ________ AASHO = A-6(10) Tested By ________

Per Cent Consolidated = 85.1

Saturated At ________ Drained 4.2 cc's Change in Length Dial .036 − .030 = .006

Change in Weight 658.9 − 657.4 = 1.5 Consolidation Time ________ Hrs.

Soil Description ________

138

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ___ Test No. 3 Date October 30, 197[illegible]
Drill Hole 13 Depth 15.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 6.7 PSI Por. B ___ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
245.0	.0183	.560	10.750	.8925	4.963	74.700	15.060			20.0			
275.0	.0185	.622	12.057	.8794	5.037	76.500	15.187			19.5			
305.0	.0187	.682	14.270	.8573	5.038	78.300	15.542			19.0			
335.0	.0189	.745	14.650	.8535	5.190	80.100	15.434			19.0			
365.0	.01915	.803	15.872	.8413	5.266	82.350	15.638			19.0			
395.0	.01935	.866	17.200	.8280	5.350	84.150	15.729			19.0			
425.0	.0195	.925	18.444	.8156	5.432	85.500	15.740			19.0			

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 3

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ______ Test No. 4 Date November 10, 19

Drill Hole 15 Depth 14.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.731 Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 45.0 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		74.4	63.1	11.3	T-320 24.6	38.5		29.4
Middle		59.4	51.9	7.5	T-328 24.7	27.2		27.6
Bottom		61.8	53.6	8.2	T-329 24.8	28.8		28.5
		58.2			24.8			

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma \Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma \Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								55.00			
20"	$.0102^{5}$	$.050^{75}$	.015	.9999	4.430	2.25	.508			55.50		.5	.984
2.0	$.0108^{5}$	$.054^{5}$	.095	.9991	4.434	7.65	1.725			56.75		1.75	1.014
5.0	.0115	$.061^{5}$	.243	.9976	4.440	13.50	3.041			57.75		2.75	.904
10.0	$.0124^{75}$	.072	.465	.9954	4.450	22.28	5.006			58.00		3.00	.599
15.0	$.0134^{5}$	.082	.676	.9932	4.460	31.05	6.962			58.75		3.75	.539
20.0	.0141	.092	.887	.9911	4.470	36.90	8.255			59.00		4.00	.484
30.0	$.0153^{5}$	.112	1.31	.9869	4.489	48.15	10.726			59.00		4.00	.373
60.0	.0177	.165	2.43	.9757	4.540	69.30	15.264			59.00		4.00	.262
90.0	$.0190^{5}$	.211	3.403	.9660	4.586	81.45	17.761			59.00		4.00	.225
120.0	.0197	.261	4.459	.9554	4.637	87.30	18.827			57.25		2.25	.120
150.0	.0205	.315	5.601	.9440	4.693	94.50	20.136			57.00		2.00	.099
180.0	.0212	.369	6.742	.9326	4.750	100.80	21.221			56.50		1.50	.071
210.0	$.0220^{5}$	.437	8.306	.9169	4.831	108.45	22.449			56.00		1.00	.045
270.0	$.0233^{5}$	.569	10.970	.8903	4.976	120.15	24.146			55.00		0.00	

Remarks ______ AASHO = A-6(11) Tested By ______

Per Cent Consolidated = 22.2

Saturated At ______ Drained 9.4 cc's Change in Length Dial .049 − .030 = .019

Change in Weight 672.8 − 671.2 = 1.6 Consolidation Time ______ Hrs.

Soil Description Gray to brown silty clay with rust & organic spots

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date November 10, 19
Drill Hole 15 Depth 74.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 45.0 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												$\Sigma\Delta P =$
Pore Pressure Increment psi												$\Sigma\Delta U =$
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
300.0	.0240	.635	12.365	.8764	5.055	126.0	24.926			53.00		-2.0	.080
330.0	.0245	.698	13.696	.8630	5.133	130.5	25.424			53.00		-2.0	.079
360.0	.0250	.758	14.965	.8504	5.209	135.0	25.917			52.00		-3.0	.116
390.0	.0254	.821	16.296	.8370	5.293	138.6	26.186			51.00		-4.0	.153
420.0	.0257	.883	17.607	.8239	5.377	141.3	26.279			50.00		-5.0	.190
450.0	.0260	.947	18.950	.8104	5.466	144.0	26.345			50.00		-5.0	.190

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______
Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

TRIAXIAL TEST RESULTS

Test No. 1, Series 4 Drill Hole Sta. 16 + 90 Sample Depth 19'

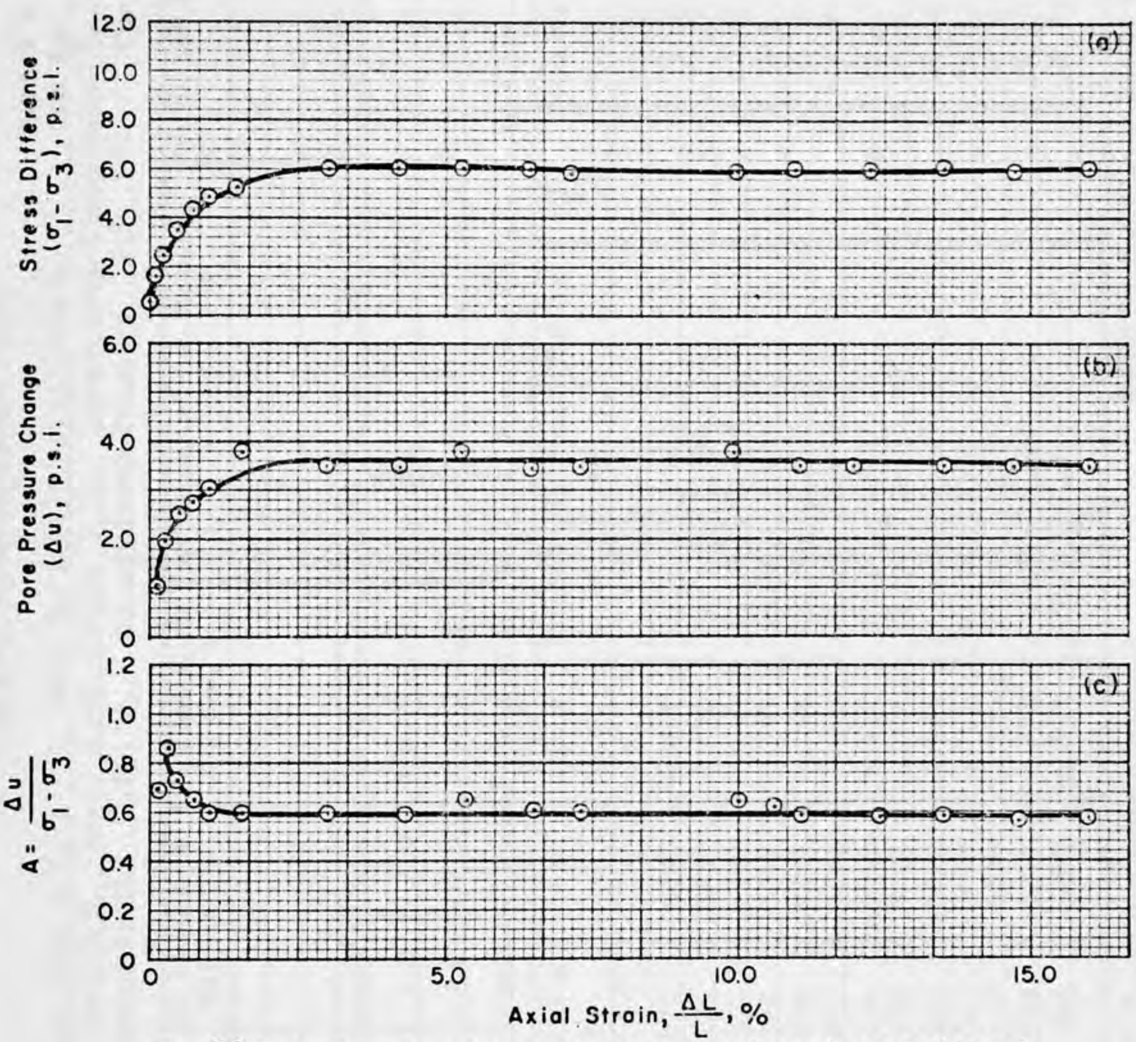

Fig. 32 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date November 18, 1
Drill Hole 14 Depth 19.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.726 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 7.0 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-304	61.8	50.6	11.2	24.8	25.8	45.4	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	1.0	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								21.00			
20"	.0103	.051	.021	.9998	4.431	2.7	.609			21.25		0.25	.041
2.0	.0107	.056	.126	.9987	4.436	6.3	1.420			22.00		1.00	.706
5.0	.0111^{5}	.065	.317	.9968	4.444	10.35	2.329			23.00		2.00	.859
10.0	.0117	.075	.528	.9948	4.453	15.30	3.436			23.50		2.50	.728
15.0	.0121	.088	.804	.9920	4.466	18.90	4.232			23.75		2.75	.650
20.0	.0124	.100	1.057	.9894	4.477	21.60	4.825			24.00		3.00	.622
30.0	.0127^{5}	.123	1.544	.9846	4.499	24.75	5.501			24.25		3.75	.591
60.0	.0130	.191	2.983	.9702	4.566	27.00	5.913			24.50		3.50	.592
90.0	.0130^{5}	.249	4.210	.9579	4.625	27.45	5.935			24.50		3.50	.590
120.0	.0131	.301	5.311	.9469	4.678	27.90	5.984			24.75		3.75	.627
150.0	.0131	.358	6.517	.9348	4.739	27.90	5.887			24.50		3.50	.593
180.0	.0131	.394	7.278	.9272	4.778	27.90	5.839			24.50		3.50	.599
250.0	.0132^{5}	.521	9.966	.9003	4.921	29.25	5.944			24.75		3.75	.631

Remarks Moisture content after test was not taken as sample was used for soluble salts on water.
AASHO = A-6 (10) Tested By ______
Per Cent Consolidated = 85.7
Saturated At ______ Drained 8.7 cc's Change in Length Dial .049 − .025 = .024
Change in Weight ______ − ______ = ______ Consolidation Time 23 Hrs.
Soil Description Rusty gray silty clay with alternating fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date November 18, 1

Drill Hole 14 Depth 19.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.726 Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 7.0 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 In.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
280.0	.0133	.578	11.172	.8883	4.987	29.70	5.955			24.50		3.50	.588
310.0	.0134	.633	12.336	.8766	5.054	30.60	6.056			24.50		3.50	.578
340.0	.0134	.689	13.520	.8648	5.123	30.60	5.973			24.50		3.50	.586
370.0	.0135	.747	14.748	.8525	5.196	31.50	6.062			24.50		3.50	.577
400.0	.0135	.805	15.975	.8483	5.161	31.50	6.103			24.50		3.50	.573

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

144

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane Over UPRR & I-15 Proj. No I-15-7(85)315 File No. ______ Test No. 2 Date November 23, 1
Drill Hole 14 Depth 19.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.561 Wet Density ____ Dry Density.
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		63.4	52.5	10.9	T-322 24.6	27.9		39.1
Middle		63.3	52.5	10.8	T-318 24.7	27.8		38.8
Bottom		62.9	52.0	10.9	T-306 24.6	27.4		39.8
		53.3	43.9	9.4	24.8	19.1	49.2	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	2.75	3.0	5.25							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	5.0	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.200								24.00			
2.0	.0118	.206	.131	.9987	4.440	16.20	3.649			27.00		3.00	.822
5.0	.0138	.216	.350	.9965	4.450	34.20	7.685			30.00		6.00	.781
8.0	.0152	.224	.526	.9947	4.450	46.80	10.517			32.00		8.00	.760
11.0	.0161	.233	.723	.9928	4.460	54.90	12.309			35.00		11.00	.894
15.0	.0170	.245	.986	.9901	4.470	63.00	14.094			37.50		13.50	.958
20.0	.0178	.257	1.249	.9875	4.490	70.20	15.635			40.00		16.00	1.023
30.0	.0185	.283	1.819	.9818	4.510	76.50	16.962			42.75		18.75	1.105
60.0	.0191	.353	3.354	.9665	4.580	81.90	17.882			47.00		23.00	1.286
90.0	.0192	.417	4.757	.9524	4.650	82.80	17.806			48.75		24.75	1.390
120.0	.0192	.481	6.160	.9384	4.720	82.80	17.542			49.50		25.50	1.454
150.0	.0192^{75}	.543	7.520	.9248	4.790	83.48	17.427			50.00		26.00	1.492
180.0	.0193	.603	8.835	.9117	4.860	83.70	17.222			50.00		26.00	1.510
201.0	.0193^{25}	.647	9.800	.9020	4.911	83.93	17.089			50.00		26.00	1.521
266.0	.0194	.677	10.458	.8954	4.948	85.05	17.189			51.00		27.00	1.571

Remarks ______ AASHO = A-7-6(11) Tested By ______

Per Cent Consolidated = 90.4

Saturated At ______ Drained ______ cc's Change in Length Dial .214 − .025 = .189

Change in Weight 587.4 − 541.3 = 46.1 Consolidation Time 26.5 Hrs.

Soil Description Rusty gray silty clay with alternating fine sand layers

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane Over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ____ Test No. 2 Date November 23, 19
Drill Hole 14 Depth 19.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.561 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure increment psi												ΣΔP =
Pore Pressure increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
296.0	.0194 25	.840	14.032	.8597	5.153	84.825	16.461			51.25		27.25	1.655
326.0	.0194 25	.900	15.347	.8465	5.233	84.825	16.210			51.25		27.25	1.681
356.0	.0194 25	.962	16.706	.8329	5.319	84.825	15.948			51.50		27.50	1.724

Remarks ____ AASHO = ____ Tested By ____
Per Cent Consolidated = ____
Saturated At ____ Drained ____ cc's Change in Length Dial ____ − ____ = ____
Change in Weight ____ − ____ = ____ Consolidation Time ____ Hrs.
Soil Description ____

140

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 3 Date 11/30/70
Drill Hole 14 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 3.641 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ___ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		76.9	63.3	13.60	T-316 24.8	38.50		35.3
Middle		63.4	53.1	10.3	T-326 24.8	28.3		26.4
Bottom		68.8	57.4	11.4	T-304 24.8	32.6		35.0
		73.3	59.4		24.8			

Back Pressure Increment psi	5.0	4.0	3.0	3.0	5.0							$\Sigma\Delta P$ = 20.0
Pore Pressure Increment psi	5.0	4.0	3.0	3.0	6.0							$\Sigma\Delta U$ = 21.0
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.150								32.75			
20"	$.0102^5$	$.150^5$	.013	.9999	4.430	2.25	.508			33.25		.50	.984
2.0	.0112	.154	.109	.9989	4.435	10.80	2.435			35.75		3.00	1.232
5.0	.0125	$.161^5$	.315	.9969	4.444	22.50	5.063			37.00		4.25	.839
10.0	.0138	.172	.604	.9940	4.457	34.20	7.673			39.00		6.25	.815
15.0	$.0147^5$	$.182^5$	.892	.9911	4.470	42.75	9.553			41.00		8.25	.864
20.0	.0155	$.192^5$	1.167	.9883	4.484	49.50	11.039			43.00		10.25	.929
30.0	.0163	.210	1.647	.9835	4.504	56.70	12.589			45.00		12.25	.978
41.0	.0168	.235	2.334	.9767	4.536	61.20	13.492			47.00		14.25	1.056
50.0	.0170	.255	2.883	.9712	4.561	63.00	13.813			48.25		15.50	1.122
60.0	.0171	.271	3.323	.9668	4.582	63.90	13.946			50.00		17.25	1.237
70.0	.0171	.292	3.900	.9610	4.610	63.90	13.861			50.25		17.50	1.263
100.0	.0171	$.349^5$	5.479	.9452	4.687	63.90	13.633			51.25		18.50	1.357
130.0	.0171	.415	7.278	.9272	4.778	63.90	13.374			52.50		19.75	1.447
160.0	.0171	$.463^{75}$	8.617	.9138	4.848	63.90	13.181			53.00		20.25	1.536

Remarks ___ AASHO = A-6(11) Tested By ___
Per Cent Consolidated = 71.7
Saturated At ___ Drained 38.0 cc's Change in Length Dial .146 − .037 = .109
Change in Weight 611.3 − 590.5 = 20.8 Consolidation Time 3 hrs. 40 min. Hrs.
Soil Description Rusty gray silty clay with alternating fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date 11/30/70

Drill Hole 14 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ______ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
190.0	.0171	.519	10.134	.8987	4.929	63.90	12.964			53.25		20.50	1.581
250.0	.0171	.632	13.238	.8676	5.106	63.90	12.515			53.75		21.00	1.678
280.0	.0171	.688	14.776	.8525	5.196	63.90	12.298			54.00		21.25	1.728
310.0	.0171	.760	16.753	.8325	5.321	63.90	12.009			54.50		21.75	1.811
340.0	.0171	.831	18.703	.8130	5.449	63.90	11.727			54.50		21.75	1.855

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 4 Date December 2, 1970
Drill Hole 14 Depth 19.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.66 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		70.5	59.9	10.6	T-325 24.8	35.1		30.2
Middle		69.7	58.4	11.3	T-329 24.8	33.6		33.6
Bottom		56.0	48.0	8.0	T-335 24.6	23.4		34.2
	T-312	66.7	56.8	9.9	24.8	32.0		30.9

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.125								22.75			
20"	.0109	.126	.021	.9998	4.43	8.10	1.828			24.00		1.25	.684
2.0	.0123	.131	.128	.9987	4.436	20.70	4.666			26.50		3.75	.804
5.0	.0141	.139[5]	.311	.9969	4.444	36.90	8.303			30.00		7.25	.873
10.0	.0157	.152	.579	.9942	4.456	51.30	11.513			34.00		11.25	.977
15.0	.0167	.163	.815	.9919	4.466	60.30	13.502			37.50		14.75	1.092
20.0	.0175	.173	1.030	.9897	4.476	65.70	14.678			40.25		17.50	1.192
30.0	.0186	.194	1.481	.9852	4.497	77.40	17.211			43.25		21.00	1.220
40.0	.0192	.211	1.845	.9816	4.513	82.80	18.347			45.00		22.25	1.213
50.0	.0194	.231	2.275	.9773	4.533	84.60	18.663			46.75		24.00	1.286
60.0	.0196	.249	2.661	.9734	4.551	86.40	18.985			47.75		25.00	1.317
70.0	.0196	.265	3.004	.9700	4.567	86.40	18.918			49.25		26.50	1.401
90.0	.0196	.300	3.756	.9674	4.579	86.40	18.869			50.00		27.25	1.444
120.0	.0196	.354	4.915	.9509	4.659	86.40	18.545			51.00		28.25	1.523

Remarks *Top part of sample was almost brittle, unable to use penetrometer. AASHO=A-6(11) Tested By ___
Per Cent Consolidated = 93.3
Saturated At ___ Drained 24.3 cc's Change in Length Dial .128 − .037 = .091
Change in Weight 642.4 − 626.9 = 15.5 Consolidation Time 14.5 Hrs.
Soil Description ___

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series #4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 5 Date December 3, 19
Drill Hole 15 Depth 14.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.736 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ____ Str. Rate .002 "/m

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		68.1	58.3	9.8	T-309 24.6	33.7		29.1
Middle		69.2	58.7	10.5	T-332 24.8	33.9		31.0
Bottom		63.0	54.2	8.8	T-320 24.6	29.6		29.7
		58.2	51.4	6.8	T-306 24.6	26.8		

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec														

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								50.00			
20"	.0104	.05175	.036	.9996	4.432	3.60	.812			50.75		.75	.924
2.0	.0112	.057	.147	.9985	4.437	10.80	2.434			53.50		3.50	1.438
5.0	.0120	.065	.316	.9968	4.444	18.00	4.050			55.00		5.00	1.235
10.0	.0131	.078	.591	.9941	4.456	27.90	6.261			55.25		5.25	.839
15.0	.01395	.088	.802	.9920	4.466	35.55	7.960			56.00		6.00	.754
20.0	.0147	.098	1.013	.9899	4.475	42.30	9.453			56.25		6.25	.661
30.0	.0161	.121	1.499	.9850	4.497	54.90	12.208			56.75		6.75	.548
40.0	.0172	.140	1.900	.9810	4.516	64.80	14.348			56.75		6.75	.470
50.0	.0182	.159	2.301	.9770	4.534	73.80	16.277			56.75		6.75	.415
60.0	.0191	.175	2.639	.9736	4.550	81.90	18.000			56.25		6.25	.347
90.0	.0211	.230	3.800	.9620	4.605	99.90	21.692			53.50		3.50	.161
120.0	.0214	.276	4.771	.9523	4.652	102.60	22.055			53.00		3.50	.159
150.0	.0236	.328	5.869	.9413	4.706	122.40	26.009			52.25		2.25	.087
180.0	.0246	.390	7.179	.9282	4.773	131.40	27.530			50.00			

Remarks *Unable to use penetrometer on middle of sample as it was crumbly sand. AASHO= ______ Tested By ______
Per Cent Consolidated = 27.7
Saturated At ______ Drained 7.4 cc cc's Change in Length Dial .045 − .031 = .014
Change in Weight ______ − ______ = ______ Consolidation Time 2 hrs 10 min. Hrs.
Soil Description Silty clay with fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 4

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ____ Test No. 5 Date December 3, 1
Drill Hole 15 Depth 14.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ____ Wet Density ____ Dry Density
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.5 PSI Par. B ____ Str. Rate .002 "/r

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												$\Sigma \Delta P$ =
Pore Pressure Increment psi												$\Sigma \Delta U$ =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
190.0	.247	.411	7.622	.9378	4.775	132.30	27.707			50.00			
250.0	.2635	.547	10.494	.8851	5.005	147.15	29.400			50.00			
280.0	.271	.610	11.824	.8818	5.024	153.90	30.633			49.00		-1.00	-.033
310.0	.277	.673	13.154	.8685	5.101	159.30	31.229			48.00		-2.00	-.064
340.0	.281	.736	14.484	.8552	5.180	162.90	31.448			47.75		-2.25	-.072
370.0	.289	.797	15.772	.8423	5.259	170.10	32.345			47.25		-2.75	-.085

Remarks ____ AASHO = ____ Tested By ____
Per Cent Consolidated = ____
Saturated At ____ Drained ____ cc's Change in Length Dial ____ − ____ = ____
Change in Weight ____ − ____ = ____ Consolidation Time ____ Hrs.
Soil Description ____

TRIAXIAL TEST RESULTS

Test No. 1, Series 5 Drill Hole Sta. 15 + 60 Sample Depth 20'

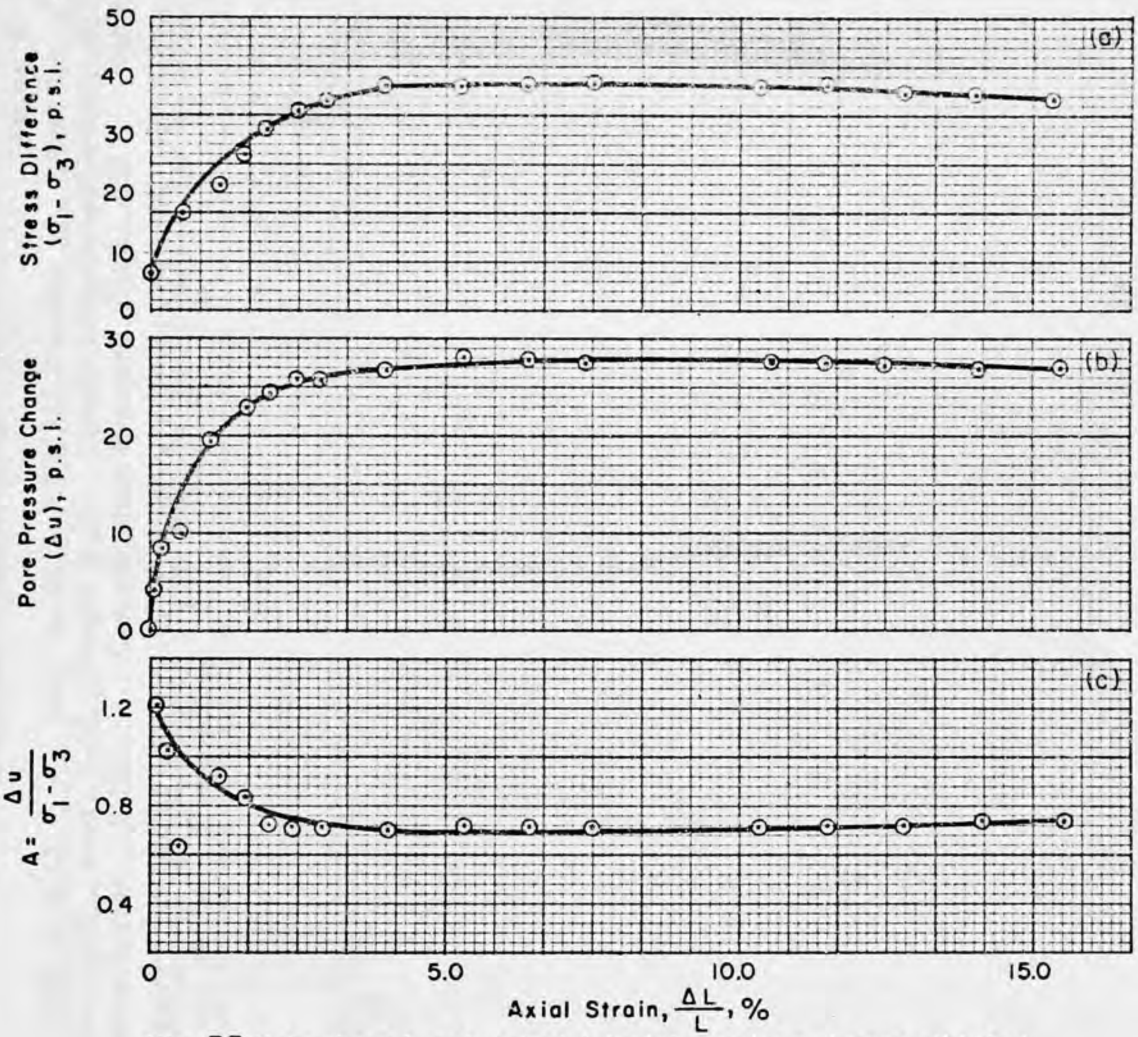

Fig. 33 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85(315 File No. ___ Test No. 1 Date December 4, 19
Drill Hole 12 Depth 20.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.691 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ___ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		60.8	53.0	7.8	T-331 24.9	28.10		27.8
Middle		75.3	65.0	10.3	T-308 24.7	40.3		25.6
Bottom		61.7	53.9	7.8	T-323 24.8	29.1		26.8
	T-301	76.2	64.7	11.5	24.9	39.8	28.9	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								22.25			
20"	.0103[5]	.101[5]	.031	.9997	4.431	3.15	.711			22.25		0	
2.0	.0118	.105	.106	.9989	4.435	16.20	3.653			26.50		4.25	1.169
5.0	.0141	.113	.277	.9972	4.442	36.90	8.307			30.75		8.5	1.023
10.0	.0178	.129	.618	.9938	4.458	70.20	15.74			32.25		10.0	.635
20.0	.0205	.153	1.129	.9887	4.481	94.50	21.089			41.75		19.5	.925
30.0	.0235	.0175	1.598	.9840	4.502	121.50	26.988			45.00		22.75	.843
40.0	.0256	.0196	2.046	.9795	4.523	140.40	31.041			46.50		24.25	.781
50.0	.0269	.215	2.451	.9755	4.541	152.10	33.495			48.00		25.75	.769
60.0	.0278	.237	2.920	.9708	4.563	160.20	35.108			48.00		25.75	.733
90.0	.0295	.292	4.092	.9591	4.619	175.50	37.995			49.00		26.75	.704
120.0	.0302	.347	5.265	.9474	4.676	181.80	38.879			50.00		27.75	.714
150.0	.0307	.400	6.395	.9361	4.732	186.30	39.370			50.00		27.75	.705
180.0	.0309	.454	7.546	.9245	4.792	188.10	39.293			50.00		27.75	.706
250.0	.0312	.588	10.402	.8960	4.944	190.80	38.592			50.00		27.75	.719

Remarks ___ AASHO = A-6(10) Tested By ___
Per Cent Consolidated = 95.5
Saturated At ___ Drained 17.1 cc's Change in Length Dial .093 − .034 = .059
Change in Weight 671.3 − 659.4 = 11.9 Consolidation Time 64 Hrs.
Soil Description Brownish gray silty clay with rust spots and pebbles throughout

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 1 Date December 4, 1970
Drill Hole 12 Depth 20.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
280.0	.0312^5	.643	11.575	.8843	5.010	191.25	38.174			49.75		27.50	.720
310.0	.0312^75	.701	12.811	.8719	5.081	191.48	37.685			49.75		27.50	.730
340.0	.0312^75	.762	14.112	.9589	5.158	191.48	37.158			49.75		27.50	.740
370.0	.0312^75	.821	15.369	.8463	5.235	191.48	36.576			49.25		27.00	.738

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

Form R-370
Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 ______ Date December 7, 197
Drill Hole 12 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.5 Length After Consolidation 4.491 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 7.7 PSI Par. B ______ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	1-327	48.0	43.1	4.9	24.9	18.2	26.9	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								21.75			
20"	.0102	.051	.022	.9998	4.431	1.80	.406			22.00		0.25	.616
2.0	.0109	.055	.111	.9989	4.435	8.10	1.826			23.00		1.25	.685
5.0	$.0116^5$	$.063^5$	.300	.9970	4.443	14.85	3.342			23.75		2.00	.598
10.0	$.0125^5$	.076	.578	.9942	4.456	22.95	5.150			24.75		3.00	.583
15.0	.0134	.089	.868	.9913	4.469	30.60	6.847			24.75		3.00	.438
20.0	.0141	.101	1.135	.9887	4.481	36.90	8.235			24.75		3.00	.364
33.0	.0158	.132	1.825	.9818	4.512	52.20	11.569			24.50		2.75	0.238
50.0	$.0173^5$	.173	2.738	.9726	4.555	66.15	14.522			23.50		1.75	.121
80.0	.0182	.235	4.119	.9588	4.620	73.80	15.974			22.00		2.50	.016
110.0	.0188	$.292^5$	5.399	.9460	4.683	79.20	16.912			21.00		-.75	-.044
140.0	.0191	.332	6.279	.9372	4.727	81.90	17.326			21.24		-.50	-.029
210.0	.0197	.464	9.218	.9078	4.880	87.30	14.889			21.00		-.75	-.042
240.0	.0198	.520	10.465	.8954	4.948	88.20	17.825			20.00		-1.75	-.098
270.0	$.0200^5$	.580	11.805	.8820	5.023	90.45	18.007			21.00		-.75	-.042

Remarks ______ AASHO = A-6(12) Tested By ______

Per Cent Consolidated = 77.3

Saturated At ______ Drained 6.1 cc's Change in Length Dial .046 - .037 = .009

Change in Weight 648.3 - 648.9 = ______ Consolidation Time ______ Hrs.

Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date December 7, 1970
Drill Hole 12 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ______ Dry Density ______
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 7.7 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
300.0	.0201	.640	13.137	.8686	5.100	90.90	17.824			20.00		-1.75	-.098
330.0	.0202	.699	14.451	.8555	5.178	91.80	17.729			19.75		-2.00	-.113
360.0	.0203	.758	15.764	.8424	5.259	92.70	17.627			19.50		-2.25	-.128

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date December 14, 197

Drill Hole 12 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.705 Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		34.0	28.9	5.1	T-339 12.0	16.9		30.2
Middle		41.4	34.7	6.8	T-338 12.0	22.7		29.5
Bottom		36.1	30.7	5.4	T-337 12.0	18.7		28.9
	T-321	78.2	66.7	15.5	24.9	41.8	27.5	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								30.50			
20"	.0106^{5}	.101^{5}	.031	.9997	4.431	5.85	1.320			31.00		.50	.379
2.0	.0122	.106	.127	.9987	4.436	19.80	4.463			33.00		2.50	.560
5.0	.0150	.114	.297	.9970	4.443	45.00	10.128			36.75		6.25	.617
10.0	.0190	.126	.552	.9945	4.454	81.00	18.186			42.00		11.50	.637
15.0	.0219	.140	.850	.9915	4.468	107.10	23.970			44.25		13.75	.574
20.0	.0239	.153	1.126	.9887	4.481	125.10	27.918			47.00		16.50	.591
30.0	.0266	.175	1.594	.9841	4.502	149.40	33.185			50.00		19.50	.588
40.0	.0278	.197	2.061	.9794	4.523	160.20	35.419			50.50		20.00	.565
60.0	.0289	.240	2.975	.9705	4.565	168.30	36.867			53.00		22.50	.610
90.0	.0289^{5}	.297	4.187	.9581	4.624	170.10	36.786			53.00		22.50	.612
120.0	.0288^{5}	.259	5.504	.9450	4.688	170.55	36.380			53.00		22.50	.618
150.0	.0288^{5}	.425	6.907	.9309	4.759	169.65	35.648			53.00		22.50	.631
180.0	.0288^{5}	.473	7.927	.9207	4.812	169.65	35.256			53.00		22.50	.638
210.0	.0288^{5}	.532	9.606	.9039	4.901	169.65	34.615			53.00		22.50	.650

Remarks ______________________ AASHO = A-6(12) Tested By ______________

Per Cent Consolidated = 79.0

Saturated At ______________ Drained 16.3 cc's Change in Length Dial .080 − .035 = .045

Change in Weight 666.7 − 659.3 = 7.4 Consolidation Time ______________ Hrs.

Soil Description Brown to gray silty clay with some fine sand

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date December 14, 197
Drill Hole 12 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B _____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P$ =
Pore Pressure Increment psi													$\Sigma\Delta U$ =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
275.0	.02885	.660	11.902	.8810	5.028	169.65	33.741			53.00		22.50	.667
305.0	.0289	.719	13.156	.8684	5.101	170.10	33.346			53.00		22.50	.675
335.0	.0289	.777	14.388	.8561	5.175	170.10	32.870			53.00		22.50	.685

Remarks ______________________ AASHO = ____________ Tested By ____________
______________________ Per Cent Consolidated = ____________
Saturated At ____________ Drained ____________ cc's Change in Length Dial ________ – ________ = ________
Change in Weight ________ – ________ = ________ Consolidation Time ____________ Hrs.
Soil Description ____________________________

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date December 15, 197
Drill Hole 12 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.679 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		67.1	58.0	9.1	T-311 24.7	33.3		27.3
Middle		66.2	56.2	10.0	T-312 24.8	31.4		31.8
Bottom		65.0	56.1	8.9	T-330 24.8	31.3		28.4
	T-335	69.2	59.2	10.0	24.6	34.4	29.11	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0100	.050								36.50			
20"	.0105	$.051^{5}$	.032	.9997	4.431	4.50	1.016			37.00		0.50	.492
2.0	.01225	$.056^{5}$	.138	.9986	4.436	20.25	4.565			39.00		2.50	.548
5.0	.0149	.065	.320	.9968	4.444	44.10	9.923			42.75		6.25	.630
10.0	.0184	.078	.598	.9946	4.457	75.60	16.962			47.50		11.00	.648
15.0	$.0211^{5}$	.090	.855	.9915	4.468	100.35	22.460			48.25		11.75	.523
20.0	.0233	.100	1.068	.9893	4.478	119.70	26.731			51.00		14.50	542
25.0	.0250	.114	1.367	.9863	4.492	135.00	30.053			51.50		15.00	.499
30.0	.0263	.125	1.602	.9842	4.502	146.70	32.586			52.75		16.25	.499
40.0	.0279	.147	2.073	.9793	4.524	161.10	35.610			53.25		16.75	.470
50.0	.0286	.167	2.500	.9750	4.544	167.40	36.840			53.75		17.25	.468
60.0	.0289	.187	2.927	.9707	4.564	170.10	37.270			54.00		17.50	.470
90.0	$.0290^{5}$	.247	4.210	.9579	4.625	171.45	37.770			53.75		17.25	.465
120.0	$.0290^{5}$	.306	5.471	.9453	4.686	171.45	36.588			53.25		16.75	.458
150.0	$.0290^{5}$	.364	6.710	.9329	4.749	171.45	36.102			53.00		16.50	.457

Remarks ______ AASHO = A-6(10) Tested By ______
Per Cent Consolidated = 67.0
Saturated At ______ Drained 12.1 cc's Change in Length Dial .053 - .036 = .017
Change in Weight 675.1 - 669.0 = 6.1 Consolidation Time 1.5 Hrs.
Soil Description Brownish gray silty clay with rust and organic spots, some fine sand.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 5

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 4 Date December 15, 197[illegible]
Drill Hole 12 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ___ Str. Rate .002 "/mi[illegible]

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
175.0	.0290^5	.408	7.651	.9235	4.797	171.45	35.744			53.00		16.50	.462
235.0	.0290^5	.533	10.322	.8968	4.940	171.45	34.706			52.50		16.00	.461
265.0	.0290^5	.590	11.540	.8846	5.008	171.45	34.285			52.50		16.00	.467
295.0	.0290^5	.648	12.780	.8722	5.079	171.45	33.757			52.50		16.00	.474
325.0	.0290^5	.706^5	14.030	.8597	5.153	171.45	33.240			52.50		16.00	.481
355.0	.0290^5	.765	15.281	.8472	5.229	171.45	32.788			52.50		16.00	.489
365.0	.0290^5	.779	15.580	.8442	5.248	171.45	32.670			52.50		16.00	.490

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

TRIAXIAL TEST RESULTS

Test No. 1, Series 6 Drill Hole Sta. 15 + 60 Sample Depth 25'

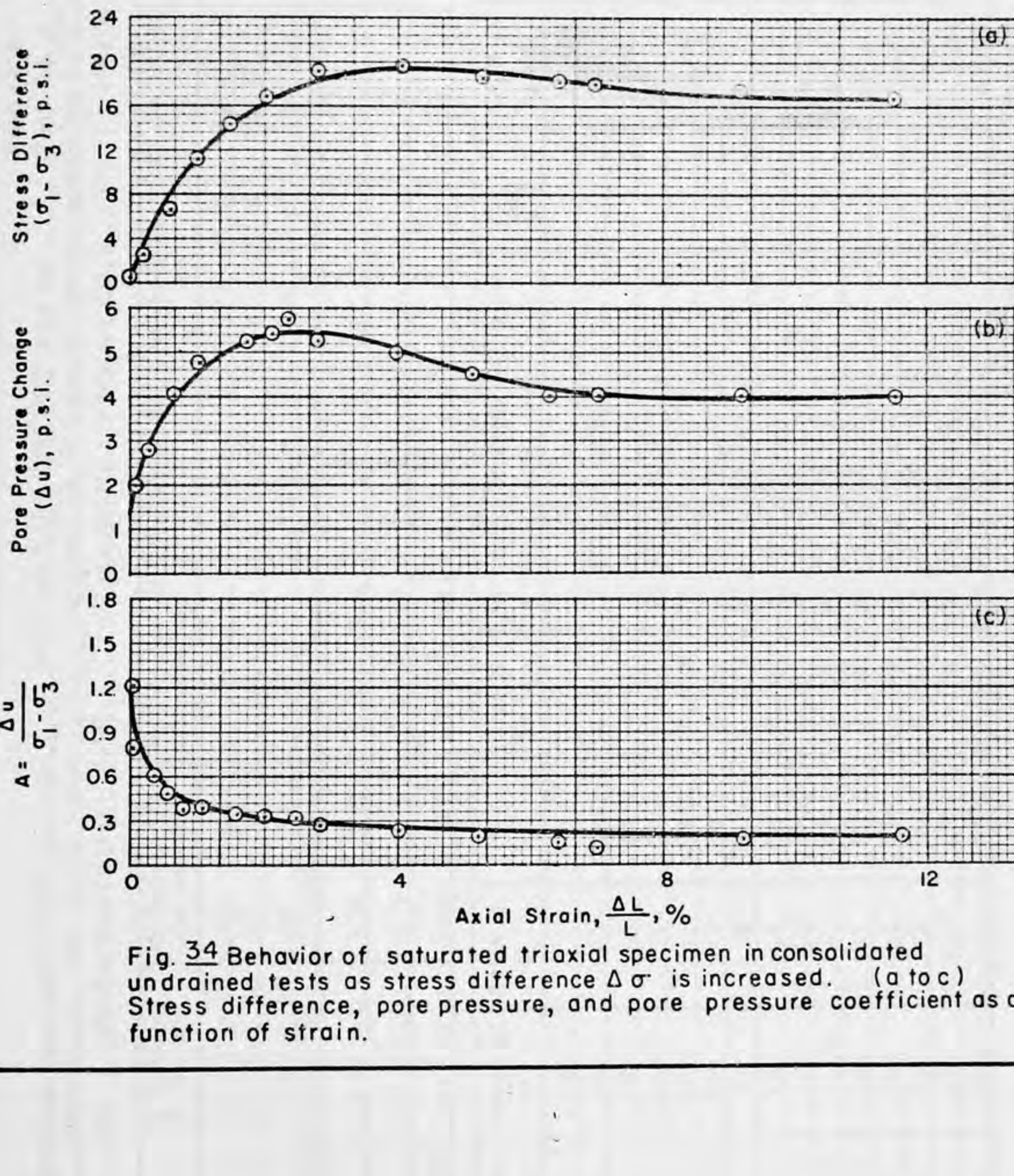

Fig. 34 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 6

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date December 17, 197
Drill Hole 12 Depth 25.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.727 Wet Density 105 Dry Density 73
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	1.40 1.35	1.40 61.7	49.2	12.5	T-323 24.8	24.4		51.2
Middle	1.35 1.40	1.35 55.8	44.7	11.1	T-320 24.6	20.1		55.2
Bottom	1.60 1.65	1.60 55.7	45.4	10.3	T-336 24.9	20.5		50.2
	T-308	56.3	46.6	9.7	24.7	21.9	44.3	

Back Pressure increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP= 20.0
Pore Pressure increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU =20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1-ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0100	.050								59.00			
20"	.0103	.051	.021	.9998	4.431	2.70	.609			59.75		.75	1.231
2.0	.0111	.057	.148	.9985	4.437	9.90	2.231			61.00		2.00	.896
5.0	.0122	.067	.359	.9964	4.446	19.80	4.453			61.75		2.75	.618
10.0	.0134	.080[5]	.645	.9936	4.459	30.60	6.863			63.00		4.00	.583
15.0	.0143[5]	.091	.867	.9913	4.469	33.18	8.760			63.25		4.25	.485
20.0	.0154	.102	1.100	.9890	4.479	48.60	10.850			63.75		4.75	.438
30.0	.0171	.125	1.586	.9841	4.502	63.90	14.194			64.25		5.25	.370
40.0	.0183[5]	.147	2.052	.9795	4.523	75.15	16.615			64.50		5.50	.331
50.0	.0190[5]	.166[5]	2.464	.9754	4.542	81.45	17.933			64.75		5.75	.321
60.0	.0193[5]	.185	2.855	.9715	4.560	84.15	18.454			64.25		5.25	.284
90.0	.0195	.243	4.082	.9592	4.618	85.50	18.515			64.00		5.00	.270
120.0	.0195	.297	5.225	.9478	4.674	85.50	18.293			63.50		4.50	.246
150.0	.0195	.354	6.431	.9357	4.734	85.50	18.061			63.00		4.00	.221
165.0	.0195	.380	6.981	.9302	4.762	85.50	17.954			63.00		4.00	.223

Remarks ______ AASHO = A-7-6(14) Tested By ______
Per Cent Consolidated = 22.0
Saturated At ______ Drained 9.7 cc's Change in Length Dial .052 - .029 = .023
Change in Weight 581.8 - 578.2 = 3.6 Consolidation Time 1 hr. and 15 min. Hrs.
Soil Description Gray to greenish gray varved silty clay with alternating fine sand lenses

Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date December 17, 197

Drill Hole 12 Depth 25.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.727 Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ____ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔ U =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	1 − ϵ	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
225.0	.0194	.486	9.223	.9078	4.880	84.60	17.458			63.00		4.0	.229
285.0	.0192	.592	11.466	.8853	5.004	82.80	16.547			63.00		4.0	.242

Remarks ______________________ AASHO = ________ Tested By ________

Per Cent Consolidated = ________

Saturated At ________ Drained ________ cc's Change in Length Dial ________ − ________ = ________

Change in Weight ________ − ________ = ________ Consolidation Time ________ Hrs.

Soil Description ________

163

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 6

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date December 18, 1970
Drill Hole 12 Depth 25.0' Dia 2.375 Area 4.43 Length 4.25 Length After Consolidation 4.17 Wet Density 110 Dry Density 78
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	2.30 2.35	2.0 61.5	50.9	10.6	T-326 24.8	26.1		40.6
Middle	1.70 1.70	1.60 65.1	53.1	12.0	T-317 24.9	28.2		42.6
Bottom	2.0 1.90	56.4 56.4	46.6	9.8	T-300 24.7	31.9		44.7
	T-313	85.1	67.3	17.8	24.8	42.5	41.9	

Back Pressure Increment psi	3.0	3.0	4.0	5.0	5.0									ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	4.0	5.0	5.0									ΣΔU = 20.0
Elapsed Time, min-sec														

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.098								21.00			
20"	.0115	.101	.071	.9993	4.433	13.5	3.045			22.75		1.75	.575
2.0	.0136	.110	.287	.9971	4.443	32.4	7.292			26.50		5.50	.752
5.0	$.0159^5$	$.119^5$	.515	.9949	4.453	53.55	12.026			30.75		9.75	.811
7.0	.0173	.126	.671	.9933	4.460	65.70	14.731			33.00		12.00	.811
10.0	.0193	.134	.863	.9914	4.468	83.70	18.733			36.75		15.75	.841
15.0	.0214	.147	1.175	.9883	4.482	102.60	22.892			40.75		19.75	.863
20.0	.0226	.159	1.462	.9854	4.496	113.40	25.222			43.25		22.25	.882
25.0	.0234	.171	1.750	.9825	4.509	120.60	26.747			45.25		24.25	.907
31.0	.0240	.185	2.086	.9791	4.525	126.00	27.845			47.00		26.00	.934
40.0	.0243	.202	2.494	.9751	4.543	128.70	28.329			49.00		28.00	.988
50.0	$.0245^5$	.226	3.069	.9693	4.570	130.95	28.654			51.25		30.25	1.056
60.0	.0246	.248	3.597	.9640	4.595	131.40	28.596			52.25		31.25	1.093
70.0	$.0246^{25}$	.269	4.100	.9590	4.619	131.63	28.496			53.75		32.75	1.149
100.0	.0247	.331	5.587	.9413	4.706	132.30	28.113			54.50		33.50	1.192

Remarks ______ AASHO = A-6(10) Tested By ______
Per Cent Consolidated = 98.0
Saturated At ______ Drained ______ cc's Change in Length Dial .098 − .018 = .080
Change in Weight ______ − ______ = ______ Consolidation Time 56.75 Hrs.
Soil Description Gray silty clay with alternating fine sand lenses

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 6

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 2 Date December 18, 1970
Drill Hole 12 Depth 25.0' Dia. 2.375 Area 4.43 Length 4.25 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
130.0	.0247	.389	6.978	.9302	4.762	132.30	27.782			56.25		35.25	1.269
160.0	.0247	.447	8.369	.9163	4.835	132.30	27.363			56.75		35.75	1.307
220.0	.0247	.565	11.199	.8880	4.989	132.30	26.518			58.00		37.00	1.395
250.0	.0247	.625	12.637	.8736	5.071	132.30	26.090			58.25		37.25	1.428
280.0	.0246[5]	.684[5]	14.064	.8594	5.155	131.85	25.577			58.50		37.50	1.466
310.0	.0246[5]	.746	15.539	.8546	5.184	131.85	25.434			58.50		37.50	1.474

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ - ___ = ___
Change in Weight ___ - ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 6

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date December 21, 1970
Drill Hole 12 Depth 25.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.743 Wet Density 107 Dry Density 72
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 9.3 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-307	102.0	77.0	25.0	24.9	52.1	48.8	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								21.00			
20"	.0102	.051[5]	.031	.9997	4.431	1.80	.406			22.00		1.00	2.463
2.0	.0108	.057	.147	.9985	4.437	7.20	1.623			23.25		2.25	1.386
5.0	.0119	.067	.358	.9964	4.446	17.10	3.846			24.50		3.50	.910
10.0	.0134	.083	.695	.9931	4.461	30.60	6.859			26.50		5.50	.803
20.0	.0158	.116	1.391	.9861	4.492	52.20	11.621			27.25		6.25	.538
30.0	.0172	.145	2.003	.9800	4.520	64.80	14.336			27.25		6.25	.436
60.0	.0184	.222	3.626	.9637	4.597	75.60	16.446			25.00		4.00	.243
90.0	.0184[5]	.292	5.102	.9490	4.668	76.05	16.292			24.50		3.50	.215
120.0	.0185	.365	6.642	.9336	4.745	76.50	16.122			24.25		3.25	.202
150.0	.0185	.435	8.118	.9188	4.822	76.50	15.865			24.00		3.00	.189
230.0	.0185	.489	9.256	.9074	4.882	76.50	15.670			24.00		3.00	.191
290.0	.0185	.628	12.187	.8781	5.045	76.50	15.164			24.00		3.00	.198
320.0	.0185	.697	13.642	.8636	5.130	76.50	14.912			24.00		3.00	.201
350.0	.0185	.768	15.139	.8486	5.220	76.50	14.655			24.00		3.00	.205

Remarks ______ AASHO = A-7-5(11) Tested By ______
Per Cent Consolidated = 89.2
Saturated At ______ Drained 9.5 cc's Change in Length Dial .049[5] − .042 = .0075
Change in Weight ______ − ______ = ______ Consolidation Time 16.5 Hrs.
Soil Description Gray silty clay with alternating fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 6

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date 1/11/71
Drill Hole 12 Depth 25.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.619 Wet Density 102 Dry Density 65
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top 2.25	1.85 2.10	52.3	42.4	9.9	T-336 24.9	17.5		56.6
Middle 1.70	1.35 1.35	62.4	49.3	13.1	T-331 24.9	24.4		53.7
Bottom 1.85	2.0 1.90	45.6	37.6	8.0	T-300 24.7	12.9		62.0
	T-309	68.4	52.5	15.9	24.6	27.7	57.0	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	2.5	3.0	5.5								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	7.0min	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	1−ϵ	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.150								42.75			
20"	.0104	.151	.021	.9998	4.431	3.60	.812			32.00		.25	.308
2.0	.0115	.156	.129	.9987	4.436	13.50	3.043			45.00		2.25	.739
5.0	.0129	.164	.303	.9970	4.443	26.10	5.874			48.00		5.25	.894
10.0	.0148	.078	.606	.9939	4.457	43.20	9.693			50.75		8.00	.825
15.0	.0164	.190	.865	.9914	4.468	57.60	12.892			52.50		9.75	.756
20.0	.0180	.205	1.190	.9881	4.483	72.00	16.061			54.00		11.50	.700
30.0	.0200	.230	1.731	.9827	4.508	90.00	19.964			57.00		14.25	.714
40.0	.0213	.251	2.186	.9781	4.529	101.70	22.455			58.00		15.25	.679
50.0	.02205	.275	2.706	.9729	4.553	108.45	23.819			59.00		16.25	.682
60.0	.0225	.295	3.139	.9686	4.574	112.50	24.596			59.75		17.00	.691
80.0	.0230	.337	4.048	.9595	4.617	117.00	25.341			61.00		18.25	.720
110.0	.0231	.400	5.412	.9459	4.683	117.90	25.176			62.00		19.25	.765
140.0	.0231	.462	6.754	.9325	4.751	117.90	24.816			62.25		19.50	.786
210.0	.0231	.604	9.828	.9017	4.913	117.90	23.998			62.75		20.00	.833

Remarks ______ AASHO = A-7-5(20) Tested By ______
Per Cent Consolidated = 54.5
Saturated At 20.0 Drained 18.5 cc's Change in Length Dial .169 − .038 = .131
Change in Weight 564.1 − 550.8 = 13.3 Consolidation Time 5.66 Hrs.
Soil Description Greenish gray silty clay with alternating fine sand lenses and layers

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 6

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 4 Date 1/11/71

Drill Hole 12 Depth 25.0' Dia 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
240.0	.0231	.662	11.084	.8892	4.982	117.9	23.665			63.25		20.5	.866
270.0	.0231	.723	12.405	.8760	5.057	117.9	23.314			63.25		20.5	.879
300.0	.0231	.788	13.812	.8619	5.140	117.9	22.938			63.25		20.5	.894
330.0	.0231	.852	15.198	.8480	5.224	117.9	22.569			63.25		20.5	.908

Remarks ___ AASHO = ___ Tested By ___

Per Cent Consolidated = ___

Saturated At ___ Drained ___ cc's Change in Length Dial ___ - ___ = ___

Change in Weight ___ - ___ = ___ Consolidation Time ___ Hrs.

Soil Description ___

TRIAXIAL TEST RESULTS

Test No. 1, Series 7 Drill Hole Sta. 15 + 60 Sample Depth 30'

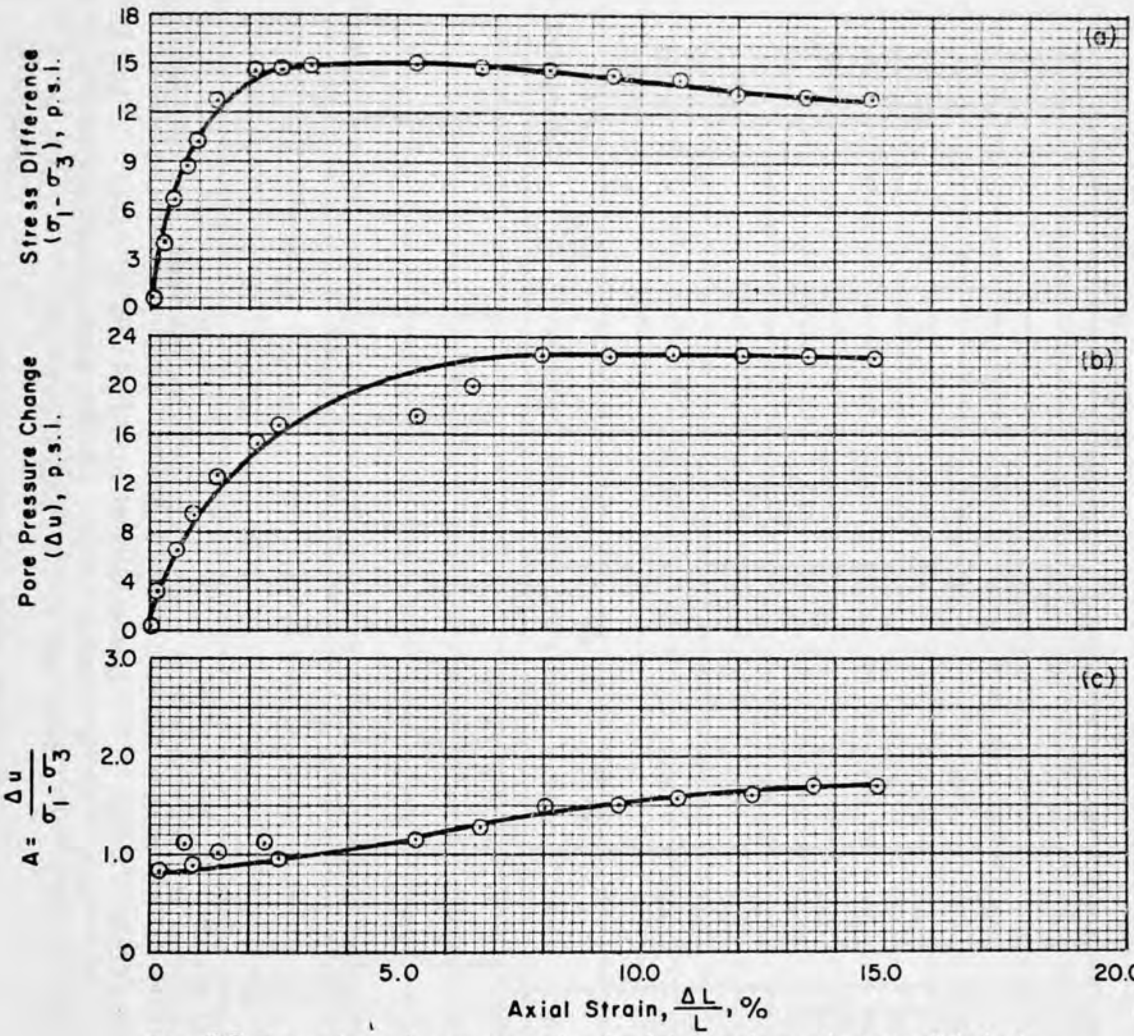

Fig. 35 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date December 24, 1970
Drill Hole 12 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.574 Wet Density 103 Dry Density 65
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min

3.6

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		50.9	42.6	8.3	T-310 25.0	17.6		47.2
Middle		52.4	43.7	8.7	T-320 24.6	19.1		45.5
Bottom		53.5	44.8	8.7	T-335 24.6	20.2		43.1
	T-316	84.6	62.6	22.0	24.8	37.8	58.2	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.200								34.25			
20"	.0105	.201	.021	.9998	4.431	4.50	1.016			35.00		.75	.938
2.0	.01125	.204	.087	.9991	4.434	11.25	2.537			37.75		3.50	1.380
5.0	.0123	.212	.262	.9974	4.442	20.70	4.660			38.25		4.00	.858
10.0	.0134	.223	.502	.9950	4.452	30.60	6.873			41.00		6.75	.982
15.0	.0142	.232	.699	.9930	4.461	37.80	8.473			43.75		9.50	1.121
20.0	.0151	.242	.918	.9908	4.471	45.90	10.266			44.00		9.75	.950
30.0	.0163	.262	1.355	.9865	4.491	56.70	12.265			47.00		12.75	1.010
50.0	.0172	.299	2.164	.9784	4.528	64.80	14.311			50.00		15.75	1.101
60.0	.0174	.321	2.645	.9736	4.550	66.60	14.637			50.75		16.50	.992
120.0	.0177	.447	5.400	.9460	4.683	69.30	14.798			52.00		17.75	1.199
150.0	.0177	.508	6.733	.9367	4.729	69.30	14.653			54.00		19.75	1.348
180.0	.0177	.570	8.089	.9191	4.820	69.30	14.378			56.75		22.50	1.565
210.0	.0177	.633	9.466	.9053	4.893	69.30	14.163			56.75		22.50	1.589
240.0	.0177	.692	10.756	.8924	4.964	69.30	13.961			56.75		22.50	1.612

Remarks ______ AASHO = A-7-6(20) Tested By ______
Per Cent Consolidated = 71.5
Saturated At ______ Drained 40.0 cc's Change in Length Dial .206 − .030 = .176
Change in Weight 571.5 − 531.3 = 40.3 Consolidation Time 94 Hrs.
Soil Description Light gray, varved clay with fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 1 Date December 24, 1970
Drill Hole 12 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P =$
Pore Pressure Increment psi													$\Sigma\Delta U =$
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
270.0	.0177	.755	12.133	.8787	5.052	69.3	13.717			57.00		22.75	1.659
300.0	.0177	.816	13.467	.8653	5.120	69.3	13.535			57.00		22.75	1.681
330.0	.0177	.878	14.882	.8518	5.201	69.3	13.324			57.00		22.75	1.707

Remarks ___ AASHO= ___ Tested By ___
Per Cent Consolidated= ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date December 30, 197
Drill Hole 12 Depth 30.0 Dia. ______ Area 2.375 Length 4.5 Length After Consolidation 4.473 Wet Density 105 Dry Density 6
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 10.9 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		Moisture content and penetrometer were not taken because						
Middle		sample was remolded & water extracted for soluble salts.						
Bottom								

Back Pressure Increment psi	5.0	5.0	10.0	10.0									ΣΔP = 30.0
Pore Pressure Increment psi	5.0	5.0	10.0	10.0									ΣΔU = 30.0
Elapsed Time, min-sec	Inst	Inst	Inst	Inst									

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	σ1/σ3	Pore Press u, psi	u in inches of Hg	Δu, psi	A = Δu/(σ1−σ3)
0.0	.0100	.050								31.75			
20"	.0102	.051	.022	.9998	4.431	1.8	.406			32.00		.25	.616
2.0	.0108	.054	.134	.9987	4.436	7.2	1.623			34.00		2.25	1.386
5.0	.0116	.065	.335	.9967	4.444	14.4	3.243			35.00		3.25	1.002
10.0	.0124	.082	.715	.9929	4.462	21.6	4.841			36.25		4.50	.930
15.0	.0132	.095	1.006	.9899	4.475	28.8	6.436			37.50		5.75	.893
20.0	.0139^{5}	.109	1.319	.9868	4.489	35.55	7.919			37.75		5.50	.695
30.0	.0149	.136	1.922	.9808	4.517	44.1	9.763			38.25		6.50	.666
40.0	.0156	.162	2.503	.9750	4.544	50.4	11.092			38.75		7.00	.631
60.0	.0161	.212	3.621	.9638	4.596	54.9	11.945			38.00		6.25	.523
90.0	.0161	.284	5.231	.9477	4.674	54.9	11.746			37.75		6.00	.511
120.0	.0161	.355	6.818	.9318	4.754	54.9	11.548			37.25		5.50	.476
180.0	.0159	.496	9.970	.9005	4.921	53.1	10.790			37.00		5.25	.445
210.0	.0158	.561	11.424	.8858	4.986	52.2	10.469			37.00		5.25	.501
240.0	.0157	.627	12.898	.8710	5.086	51.3	10.087			37.00		5.25	.521

Remarks ______ AASHO = A-7-6(19) Tested By ______
Per Cent Consolidated = 83.9
Saturated At 30.0 Drained 8.0 cc's Change in Length Dial .057 − .030 = .027
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description Gray to black varved organic clay

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 2 Date December 30, 1970
Drill Hole 12 Depth 30.0 Dia. ___ Area 2.375 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 10.9 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P$ =
Pore Pressure Increment psi													$\Sigma\Delta U$ =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
270.0	.0157	.691	14.330	.8567	5.171	51.3	9.921			36.75		5.0	.504
300.0	.0156	.757	15.805	.8420	5.261	50.4	9.580			36.75		5.0	.522

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ______ Test No. 3 Date January 12, 1971

Drill Hole 12 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.50 Length After Consolidation 4.389 Wet Density 107 Dry Density 71

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top		58.30	47.9	10.4	T-313 24.8	23.1		45.0
Middle		50.00	42.3	7.7	T-319 24.7	17.6		43.8
Bottom		45.85	39.6	6.25	T-320 24.6	15.0		41.7
	T-318	103.4	77.4	26.0	24.7	52.7	49.3	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0100	.150								48.25			
20"	.0106	.151	.022	.9998	4.431	5.40	1.219			49.25		1.00	.828
2.0	.0115	.156	.136	.9986	4.436	13.50	3.043			51.00		2.75	.904
5.0	.0128	.165	.341	.9966	4.445	25.20	5.669			54.50		5.25	1.102
10.0	.0144	.180	.683	.9932	4.460	39.60	8.879			56.25		8.00	.901
15.0	.0158	.194	1.002	.9900	4.475	52.20	11.665			58.25		10.00	.857
20.0	.0167	.206	1.275	.9873	4.487	60.30	13.439			58.50		10.25	.763
30.0	.0175	.230	1.822	.9818	4.512	67.50	14.960			59.00		10.75	.719
40.0	.0177[5]	.260	2.506	.9749	4.544	69.75	15.349			59.00		10.75	.700
50.0	.0180	.282	3.007	.9699	4.567	72.00	15.765			59.50		11.25	.718
84.0	.0181	.359	4.661	.9524	4.651	72.90	15.674			59.75		11.50	.734
114.0	.0181	.416	6.060	.9394	4.716	72.90	15.458			61.00		12.75	.825
194.0	.0181	.586	9.933	.9007	4.918	72.90	14.823			62.00		13.75	.928
224.0	.0181	.654	11.483	.8852	5.005	72.90	14.565			62.25		14.00	.961
254.0	.0181	.721	13.009	.8699	5.093	72.90	14.314			61.50		13.25	.926

Remarks ______ AASHO = A-7-6(16) Tested By ______

Per Cent Consolidated = 43.5

Saturated At ______ Drained .185 cc's Change in Length Dial .145 - .034 = .111

Change in Weight 558.2 - 540.5 = 16.7 Consolidation Time ______ Hrs.

Soil Description Gray to black organic clay with alternating very fine sand.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date January 12, 1971
Drill Hole 12 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.50 Length After Consolidation ______ Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
284.0	.0181	.789	14.559	.8544	5.185	72.9	14.069			61.50		13.25	.942
314.0	.0181	.858	16.131	.8387	5.282	72.9	13.802			61.50		13.25	.960

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. _____ Test No. 4 Date January 14, 1971
Drill Hole 12 Depth 30.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.486 Wet Density 107 Dry Density 71.
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B _____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top 1.65	1.65 1.60	T-312 51.5	43.8	7.7	24.8	19.0		40.5
Middle 1.55	1.50 1.45	T-310 50.8	43.1	7.7	25.0	18.1		42.5
Bottom 1.65	1.60 1.60	T-311 55.4	46.4	9.0	24.7	21.7		41.5
	T-328	64.5	51.3	13.2	24.7	26.6	49.6	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0	10.0	ΣΔP = 30.0
Pore Pressure Increment psi	3.0	2.75	3.25	3.0	3.0	5.0	10.0	ΣΔU = 30.0
Elapsed Time, min-sec	Inst.	2.0 min.	45 sec.	1 min.	Inst.	Inst.	Inst.	

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	i − ϵ	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.300								35.00			
20"	.0107	$.301^5$	.033	.9997	4.431	6.3	1.422			35.25		.25	.176
2.0	.0125	.308	.178	.9982	4.438	22.5	5.070			35.75		3.75	.740
5.0	.0149	.319	.423	.9958	4.449	44.1	9.912			44.00		9.00	.908
10.0	.0182	.337	.824	.9918	4.467	73.8	16.521			49.25		14.25	.863
15.0	.0197	.350	1.114	.9889	4.480	87.3	19.487			53.75		18.75	.962
20.0	.0206	.363	1.404	.9860	4.493	95.40	21.233			56.00		21.00	.989
30.0	$.0216^{75}$	$.387^5$	1.950	.9805	4.518	104.85	23.207			58.50		23.50	1.413
40.0	.0222	$.411^4$	2.485	.9752	4.543	109.80	25.169			60.50		25.50	1.009
50.0	.0225	.436	3.031	.9697	4.568	112.50	24.628			64.50		29.50	1.198
60.0	.0226	.458	3.599	.9640	4.595	113.40	24.079			64.50		29.50	1.195
70.0	$.0226^5$	.479	3.990	.9601	4.614	113.85	24.875			65.25		30.25	1.226
80.0	.0227	.504	4.544	.9546	4.641	114.30	24.628			66.50		31.50	1.279
90.0	$.0227^5$	.528	5.082	.9482	4.672	114.75	24.561			67.00		32.00	1.303
105.0	$.0227^5$	.562	5.840	.9416	4.705	114.75	24.389			68.00		33.00	1.353

Remarks _____ AASHO = A-7-6(17) Tested By _____
Per Cent Consolidated = 90.0
Saturated At _____ Drained 38.7 cc's Change in Length Dial .294 − .030 = .264
Change in Weight 590.1 − 553.5 = 36.6 Consolidation Time _____ Hrs.
Soil Description Gray, varved clay with alternating fine sandy seams.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 7

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ____ Test No. 4 Date January 14, 1971
Drill Hole 12 Depth 30.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.486 Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 50.0 PSI Par. B ____ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec.													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
165.0	.0228	.692	10.960	.8904	4.975	115.2	23.156			70.75		35.95	1.544
195.0	.0228	.758	12.438	.8752	5.062	115.2	22.758			70.75		35.75	1.571
225.0	.0228	.823	13.887	.8611	5.145	115.2	22.391			70.25		35.75	1.597
255.0	.0228	.888	15.336	.8466	5.233	115.2	22.014			71.25		36.25	1.647
285.0	.0228	.954	16.807	.8319	5.325	115.2	21.634			70.75		35.75	1.652
315.0	.0227	1.017	18.212	.8179	5.416	114.3	21.104			70.75		35.75	1.701

Remarks ____________________ AASHO = ________ Tested By ____________
Per Cent Consolidated = ________
Saturated At ________ Drained ________ cc's Change in Length Dial ________ − ________ = ________
Change in Weight ________ − ________ = ________ Consolidation Time ________ Hrs.
Soil Description ____________________

TRIAXIAL TEST RESULTS

Test No. 1, Series 8 Drill Hole Sta. 13 + 80 Sample Depth 33.5'

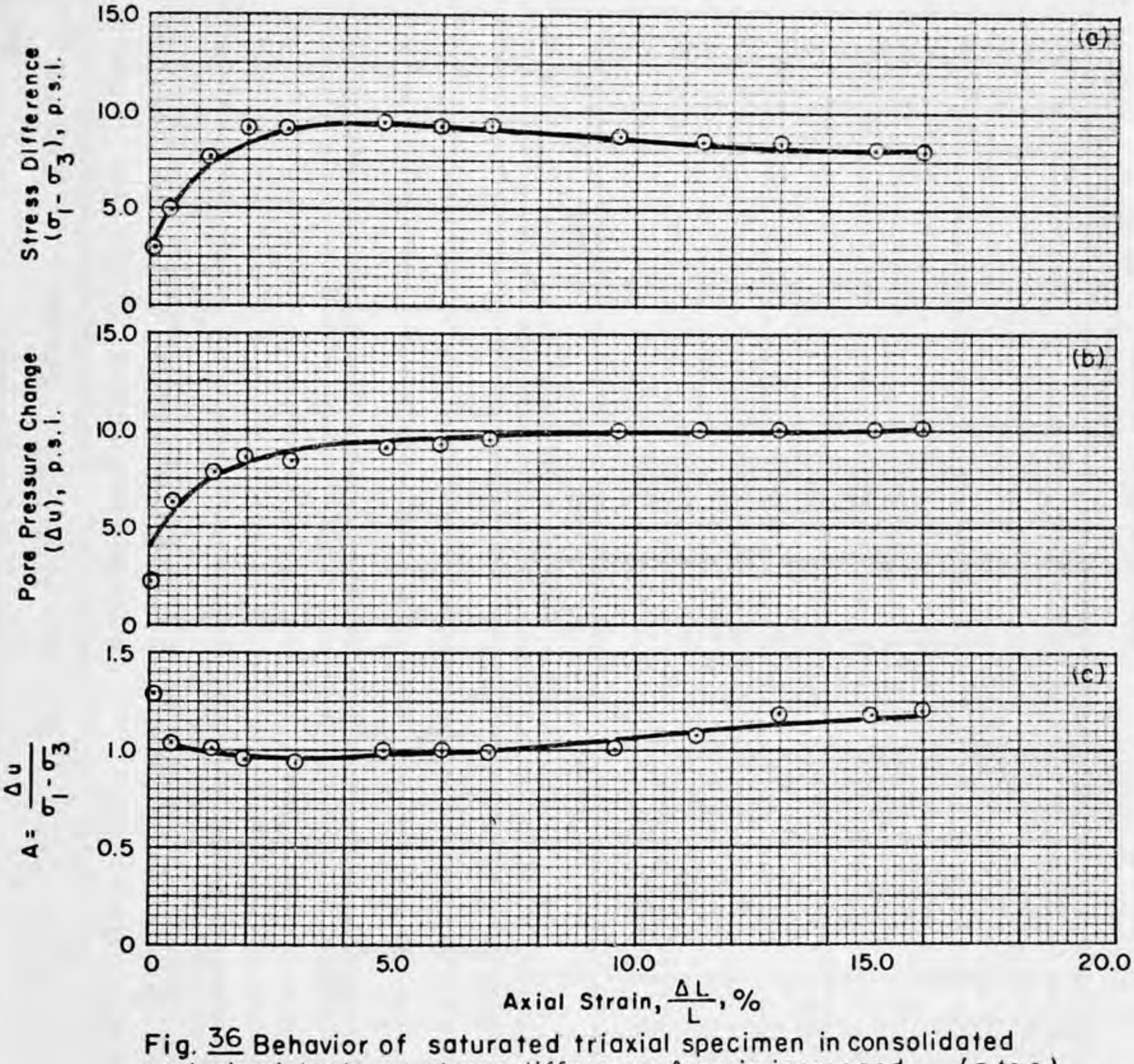

Fig. 36 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta \sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 1 Date January 28, 197
Drill Hole 10 Depth 33.5' Dia. 2.0 Area 3.14 Length 4.00 Length After Consolidation 3.933 Wet Density 67.6 Dry Density 69
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 16.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	~~T-333~~	~~120.9~~	~~86.8~~	~~34.1~~	~~24.8~~	~~62.0~~	~~55.0~~	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	i − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								22.75			
20"	.0103	.101	.025	.9998	3.141	2.70	.860			23.50		.75	.872
2.0	.0106	.105	.125	.9988	3.144	5.40	1.718			25.00		2.25	1.310
5.0	.0110	.111	.279	.9972	3.149	9.45	3.001			26.50		3.75	1.250
10.0	.0117	.121	.533	.9947	3.157	15.3	4.846			28.00		5.25	1.083
15.0	.0122	.133	.839	.9916	3.167	19.8	6.252			29.00		6.25	1.000
20.0	.0124	.143	1.093	.9891	3.175	22.05	6.945			30.00		7.25	1.044
25.0	.0127	.153	1.357	.9864	3.183	24.3	7.634			30.75		8.00	1.048
30.0	.0128	.162	1.576	.9842	3.190	25.2	7.900			31.00		8.25	1.044
40.0	.0131	.178	1.9802	.9802	3.203	27.9	8.711			31.00		8.25	.947
50.0	.0132	.196	2.440	.9756	3.219	28.8	8.947			31.00		8.25	.922
60.0	.0132	.212	2.847	.9715	3.232	29.25	9.050	25.155		31.00		8.25	.912
70.0	.0133	.226	3.203	.9680	3.244	29.7	9.155	1.811		31.00		8.25	.901
80.0	.0133	.245	3.686	.9614	3.266	29.7	9.094	T.S.F.		31.75		9.00	.990
110.0	.0133	.290	4.830	.9517	3.299	30.13	9.139			32.00		9.25	1.012

Remarks ___ AASHO = A-7-6(15) Tested By ___
Per Cent Consolidated = 82.8
Saturated At 20.0 Drained 21.8 cc's Change in Length Dial .086 − .019 = .067
Change in Weight 355.1 − ___ = ___ Consolidation Time 71 hrs. & 45 Min. ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 1 Date January 28, 1'
Drill Hole 10 Depth 33.5' Dia. 2.0 Area 3.14 Length 4.00 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 16.0 PSI Par. B ___ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P =$
Pore Pressure Increment psi													$\Sigma\Delta U =$
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$i-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
140.00	.0133	.337	6.025	.9398	3.341	30.15	9.024			32.00		9.25	1.025
170.00	.0133	.381	7.144	.9286	3.381	30.15	8.9171			32.25		9.50	1.065
230.00	.0133	.483	9.738	.9026	3.479	30.15	8.666			32.75		10.00	1.154
260.00	.0133	.546	11.339	.8866	3.452	30.15	8.512			32.75		10.00	1.175
290.00	.0133	.610	12.967	.8703	3.608	30.15	8.356			32.75		10.00	1.197
320.00	.0133	.675	14.619	.8538	3.678	30.15	8.197			32.75		10.00	1.220
350.00	.0133	.733	16.094	.8391	3.742	30.15	8.057			32.75		10.00	1.241

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ - ___ = ___
Change in Weight ___ - ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date January 21, 1971

Drill Hole 11 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.50 Length After Consolidation 4.473 Wet Density 105 Dry Density 77

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 37.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location		Container Number		Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	.65	.55	.60							
Middle	.60	.65	.55							
Bottom	.70	.65	.70							
		T-317		77.5	63.5	14.0	24.9	38.6	36.4	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta P =$ 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta U =$ 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								48.75			
20"	.0105	.051	.022	.9998	4.431	45.00	1.016			49.75		1.00	.984
2.0	.0108 5	.057	.156	.9984	4.437	72.65	1.724			51.00		2.25	1.305
5.0	.0114	.068	.402	.9960	4.448	12.60	2.833			51.25		2.50	.822
10.0	.0122	.083	.737	.9929	4.463	19.80	4.436			52.25		3.50	.789
15.0	.0130 5	.097 5	1.061	.9894	4.477	27.45	6.131			52.75		4.00	.652
20.0	.0137	.113	1.408	.9859	4.493	33.30	7.412			53.00		4.25	.573
30.0	.0143 5	.141	2.034	.9797	4.522	39.15	8.658			53.25		4.50	.520
40.0	.0147	.169	2.666	.9734	4.551	42.30	9.295			53.25		4.50	.484
70.0	.0151	.249	4.448	.9555	4.636	45.90	9.901			53.25		4.50	.454
100.0	.0157	.324	6.125	.9388	4.719	45.90	9.727			53.25		4.50	.463
130.0	.0151	.405	7.936	.9206	4.812	45.90	9.539			53.00		4.25	.446
160.0	.0151	.465	9.277	.9072	4.883	45.90	9.400			53.00		4.25	.415
190.0	.0151	.534	10.820	.8918	4.967	45.90	9.244			53.00		4.25	.460
262.0	.0151	.696	14.442	.8556	5.178	45.90	8.804			53.25		4.50	.508

Remarks ______________________ AASHO = A-7-6(16) Tested By ______________________

Per Cent Consolidated = 22.3

Saturated At 20.0 Drained 8.2 cc's Change in Length Dial .052 − .025 = .027

Change in Weight 551.7 − 545.4 = 6.3 Consolidation Time 4 hrs. + 20 min. Hrs.

Soil Description Gray varved organic clay with fine sand lenses

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date January 26, 1971
Drill Hole 11 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.674 Wet Density 104 Dry Density 66.
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 37.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top .65	.60 .60	59.5	48.4	11.1	T-327 24.9	23.5		47.2
Middle .65	.60 .60	59.5	47.5	11.8	T-326 24.8	22.7		52.0
Bottom .80	.75 .75	53.1	43.2	9.9	T-300 24.7	18.5		53.5
	T-330	79.3	59.5	19.8	24.8	34.7	57.1	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma\Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma\Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								43.75		.75	
30"	.0104	.101	.021	.9998	4.431	3.60	.812			44.50		2.25	.924
2.0	.0110	.106	.128	.9987	4.436	9.00	2.029			46.00		4.25	1.109
5.0	.0120	.116	.342	.9966	4.445	18.00	4.047			48.00		5.00	1.050
10.0	.0131	.131	.663	.9934	4.459	27.90	6.257			48.75		5.75	.799
15.0	$.0138^{5}$	.146	.984	.9902	4.474	34.65	7.745			49.50		6.25	.742
20.0	.0144	.159	1.262	.9874	4.487	39.60	8.825			50.00		6.50	.708
30.0	.0153	.186	1.839	.9816	4.513	47.70	10.431			50.25		7.00	.623
40.0	$.0156^{5}$	.209	2.332	.9767	4.536	50.85	11.210			50.75		7.00	.624
50.0	.0158	.236	2.909	.9709	4.563	52.20	11.440			50.75		7.00	.612
60.0	.0159	.260	3.432	.9657	4.589	53.10	11.576			50.75		7.25	.605
70.0	$.0159^{5}$	.281	3.872	.9613	4.608	53.55	11.621			51.00		7.25	.824
100.0	$.0159^{5}$	.357	5.498	.9450	4.688	53.55	11.423			51.00		7.50	.635
130.0	$.0159^{5}$	.475	6.953	.9305	4.761	53.55	11.248			51.25		7.75	.667
160.0	$.0159^{5}$	.494	8.429	.9157	4.838	53.55	11.069			51.50			.700

Remarks ______ AASHO = A-7-5(16) Tested By ______
Per Cent Consolidated = 35.8
Saturated At ______ Drained 14.2 cc's Change in Length Dial .095 − .019 = .076
Change in Weight 579.1 − 566.6 = 12.5 Consolidation Time 11 hrs. & 55 min. Hrs.
Soil Description Light gray to dark gray varved clay with alternating fine sand lenses.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 3 Date January 26, 1971

Drill Hole 11 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 37.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
190.0	.0159[5]	.566	9.970	.9003	4.921	53.55	10.882			51.50		7.75	.712
265.0	.0159[5]	.737	13.628	.8637	5.129	53.55	10.441			51.50		7.75	.742
295.0	.0159[5]	.809	15.169	.8483	5.222	53.55	10.255			52.00		8.25	.804

Remarks ___ AASHO = ___ Tested By ___

Per Cent Consolidated = ___

Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___

Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.

Soil Description ___

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ___ Test No. 4 Date January 22, 1971
Drill Hole 11 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.649 Wet Density 105 Dry Density 69
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 37.0 PSI Par. B ___ Str. Rate .002 "/min.

Specimen Location		Container Number		Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.		Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	.90	.85	.85	59.7	48.5	11.2	T-316	24.8	23.7		47.3
Middle	.80	.80	.80	56.0	46.0	9.3	T-306	24.6	21.7		44.7
Bottom	.90	.85	.90	53.35	44.5	8.85	T-336	24.9	19.6		45.2
		T-325		77.3	59.5	17.8	24.8		34.7	51.3	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.150								29.25			
20"	.0107	.151	.029	.9997	4.431	6.3	1.422			31.00		1.25	.879
2.0	.0114	.154[5]	.096	.9990	4.434	12.60	2.842			32.25		2.50	.880
5.0	.0123	.161	.236	.9986	4.436	20.70	4.666			34.25		4.50	.964
10.0	.0135	.171	.467	.9953	4.451	31.50	7.077			36.25		6.50	.918
15.0	.0141	.181	.665	.9933	4.460	31.90	8.273			37.75		8.00	.967
20.0	.0146	.190	.860	.9914	4.468	41.40	9.266			38.50		8.75	.944
30.0	.0155	.212	1.333	.9865	4.490	49.50	11.022			41.25		11.50	1.043
40.0	.0161	.229	1.699	.9830	4.507	54.90	12.181			41.75		12.00	.989
50.0	.0164[5]	.251	2.172	.9783	4.528	58.05	12.820			43.00		13.25	1.034
60.0	.0166	.268	2.538	.9746	4.545	59.40	13.069			44.75		15.00	1.148
70.0	.0167	.285	2.903	.9710	4.562	60.30	13.218			44.75		15.00	1.135
80.0	.0167[75]	.306	3.355	.9665	4.584	60.98	13.302			44.75		15.00	1.128
90.0	.01685	.326	3.785	.9622	4.604	61.65	13.391			45.00		15.25	1.139
100.0	.0168[5]	.348	4.258	.9574	4.627	61.65	13.324			46.00		16.25	1.220

Remarks ___ AASHO = A-7-6(16) Tested By ___
Per Cent Consolidated = 73.6
Saturated At ___ Drained 26.7 cc's Change in Length Dial .135 − .034 = .101
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description Light gray to dark gray varved clay with alternating fine sand lenses

Form R-370
Rev. 4-70

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 8

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date January 22, 1971

Drill Hole 11 Depth 30.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ______ Dry Density ______

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 37.0 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P$ =
Pore Pressure Increment psi													$\Sigma\Delta U$ =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	i − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
160.0	.016875	.466	6.797	.9320	4.753	61.875	13.018			47.00		17.25	1.319
190.0	.016875	.526	8.087	.9191	4.820	61.875	12.837			47.00		17.25	1.344
220.0	.016875	.587	9.399	.9060	4.890	61.875	12.653			47.25		17.50	1.383
250.0	.01695	.648	10.711	.8929	4.961	62.550	12.608			49.00		19.25	1.527
280.0	.01695	.708	12.002	.8800	5.034	62.550	12.426			49.00		19.25	1.549
310.0	.01695	.769	13.314	.8669	5.110	62.550	12.241			49.50		19.25	1.613
340.0	.01695	.827	14.562	.8544	5.185	62.550	12.064			49.75		20.00	1.658
370.0	.01695	.888	15.875	.8413	5.266	62.550	11.878			49.75		20.00	1.684
400.0													

Remarks ______________________ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______________________

TRIAXIAL TEST RESULTS

Test No. 1, Series 9 Drill Hole Sta. 14 + 10 Sample Depth 35'

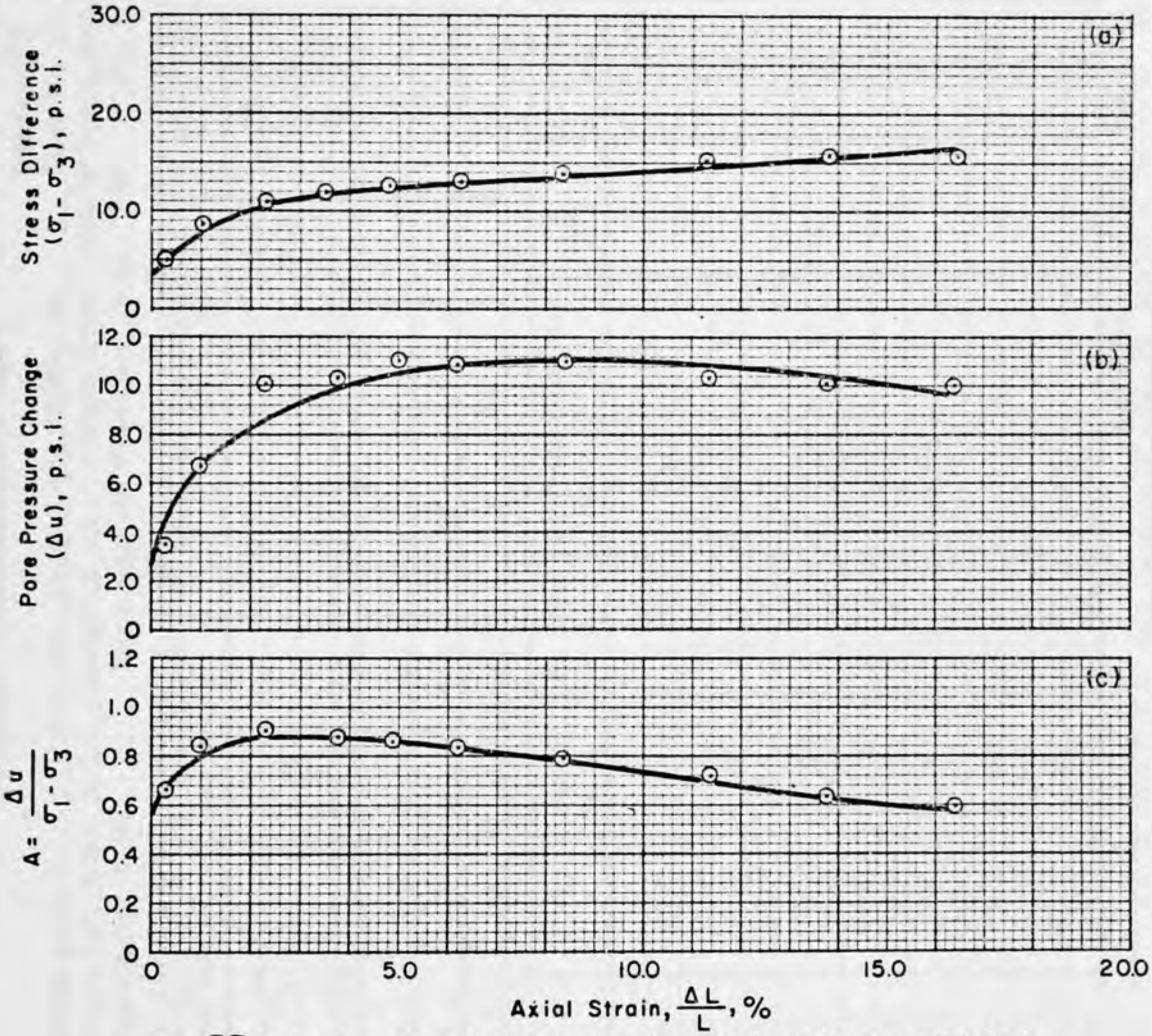

Fig. 37 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta \sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date February 7, 197
Drill Hole 11 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.685 Wet Density 119 Dry Density 92
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 19.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top of sample shattered		66.8	57.8	9.0	T-332 24.8	33.0		27.3
Middle 1.25	1.45 1.35	51.65	45.7	5.95	T-333 24.8	20.9		28.5
Bottom 1.60	1.70 1.60	58.4	50.4	8.0	T-335 24.6	25.8		31.0
	T-316	68.7	58.9	9.8	24.8	34.1	28.7	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								22.00			
20"	.0105	.101	.021	.9998	4.431	4.50	1.016			22.00			
2.0	.0114[5]	.107	.149	.9985	4.437	13.05	2.941			23.25		1.25	.425
5.0	.0126	.116	.341	.9966	4.445	23.40	5.264			25.50		3.50	.665
10.0	.0136	.134	.725	.9928	4.462	32.40	7.261			27.50		5.50	.757
15.0	.0141	.148	1.024	.9898	4.476	36.90	8.244			28.75		6.75	.819
20.0	.0145	.162	1.323	.9868	4.489	40.50	9.022			30.25		8.25	.914
30.0	.0150	.187	1.856	.9814	4.514	45.00	9.969			30.50		8.50	.853
40.0	.0154	.211	2.369	.9763	4.538	48.60	10.710			32.00		10.00	.934
50.0	.0157	.238	2.945	.9706	4.561	51.30	11.248			32.00		10.00	.889
60.0	.0160	.262	3.457	.9654	4.589	54.00	11.767			32.25		10.25	.871
70.0	.0162	.282	3.884	.9612	4.609	55.80	12.107			33.25		10.25	.840
80.0	.0164	.305	4.375	.9563	4.632	57.60	12.435			33.00		11.00	.885
90.0	.0166	.326	4.823	.9518	4.654	59.40	12.763			33.00		11.00	.862
120.0	.0171	.393	6.254	.9375	4.725	62.90	13.524			33.00		11.00	.813

Remarks ______ AASHO = A-7-6(12) Tested By ______
Per Cent Consolidated = 89.5
Saturated At 20.0 P.S.I. Drained 10.8 cc's Change in Length Dial .090 − .025 = .065
Change in Weight 659.2 − 648.8 = 10.4 Consolidation Time ______ Hrs.
Soil Description Top 2/3 = Greenish gray clayey fine sand; bottom 1/3 = Greenish gray stiff clay with black organic spots.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 1 Date February 5, 1971

Drill Hole 11 Depth 35.0' Dia 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 19.0 PSI Par. B ___ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi														ΣΔP =
Pore Pressure Increment psi														ΣΔU =
Elapsed Time, min-sec														

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
150.0	.0175	.459	7.662	.9234	4.797	67.50	14.071			33.00		11.00	.782
165.0	.0177	.489	8.303	.9170	4.831	69.30	14.345			33.00		11.00	.767
225.0	.0184	.627	11.248	.8875	4.992	75.60	15.144			32.25		10.25	.677
255.0	.0188	.682	12.422	.8758	5.058	79.20	15.658			32.00		10.00	.639
285.0	.0191	.746	13.788	.8621	5.139	81.90	15.937			32.00		10.00	.627
315.0	.0195	.809	15.133	.8487	5.220	85.50	16.379			32.00		10.00	.611
345.0	.0198	.873	16.499	.8350	5.305	88.20	16.620			32.00		10.00	.601

Remarks ___ AASHO = ___ Tested By ___

Per Cent Consolidated = ___

Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___

Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.

Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date February 18, 1971
Drill Hole 12 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.703 Wet Density 118 Dry Density 92
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 36.5 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-316	92.5	77.5	15.0	24.8	52.7	28.5	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP =
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU =
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	-.075								41.75			
20"	.0105	.076	.021	.9998	4.431	4.50	1.016			42.75		1.00	984
2.0	.0116	081	.127	.9987	4.436	14.60	3.246			44.00		2.25	.689
5.0	.0128^5	.090	.318	.9968	4.444	25.65	5.772			45.00		3.75	650
10.0	.0140	.102	.574	.9943	4.455	36.00	8.081			47.00		5.25	.650
20.0	0153	132	1.211	9879	4:484	47.70	10.638			48.75		7.00	.658
30.0	.0160	.156	1.722	.9828	4.502	54.00	11.470			49.25		7.50	654
40.0	0163	.179	2.211	.9779	4.530	56.70	12.517			49.50		7.75	.619
50.0	.0166	.201	2.679	9732	4.552	59.40	13.049			49.75		8.00	.613
60.0	.0167^5	.221	3.104	.9690	4.572	60.75	13.281			49.75		8.00	.602
70.0	0168^5	.243	3.572	.9643	4.594	61.65	13.420			49.75		8.00	.596
80.0	.0169	.264	4.018	.9598	4.477	62.10	13.871			49.50		7.75	.559
110.0	0172^5	.324	5.294	.9471	4.677	65.25	13.951			49.50		7.75	.555
140.0	.0175	.383	6.549	.9345	4.741	67.50	14.238			49.25		7.50	.527
170.0	0177^5	.443	7.824	.9218	4.806	69.75	14.516			49.25		7.50	.517

Remarks ______________________ AASHO = A-6(11) Tested By ______________

Per Cent Consolidated = 40.4

Saturated At ______________ Drained ______________ cc's Change in Length Dial .072 − .025 = .047

Change in Weight ______________ − ______________ = ______________ Consolidation Time 30 Minutes Hrs.

Soil Description ______________________________

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date February 16, 1971
Drill Hole 11 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 36.5 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
245.0	.0183	.589	10.929	.8907	4.974	74.7	15.018			48.75		7.0	.466
275.0	.0185	.647	12.162	.8784	5.043	76.5	15.170			48.75		7.0	.461
305.0	.0187	.704	13.374	.8665	5.113	78.3	15.314			48.75		7.0	.457
335.0	.0189	.764	14.650	.8535	5.190	80.1	15.434	52.06		48.75		7.0	.455
365.0	.0191	.821	15.862	.8414	5.265	81.9	15.556	3.75		48.75		6.5	.418

Remarks ______ AASHO = ______ Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date February 4, 1971
Drill Hole 11 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.709 Wet Density 121 Dry Density 97
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 36.50 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	2.80	48.3	37.6	10.7	T-337 12.0	25.6		41.8
Middle	2.75 2.10	39.6	33.8	5.2	T-340 11.8	22.0		26.4
Bottom	1.85 1.95	44.0	40.6	3.4	T-341 12.1	28.5		11.9
	T-313	63.6	55.8	7.8	24.8	31.0	25.2	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP =
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU =
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								29.00			
.20	.0107	.051	.021	.9998	4.431	6.30	1.422			29.25		.25	.176
2.0	.0117	.055	.106	.9989	4.435	15.30	3.450			31.00		2.00	.580
5.0	.0133	.064	.297	.9970	4.443	29.70	4.685			33.75		4.75	1.014
10.0	.0156	.077	.573	.9943	4.453	50.40	11.318			37.25		8.25	.729
15.0	.0172	.089	.828	.9917	4.467	64.80	14.506			39.75		10.75	.741
20.0	.0185	.102	1.104	.9890	4.479	76.50	17.080			41.00		12.00	.674
30.0	.0201	.126	1.613	.9839	4.502	90.90	20.191			43.00		14.00	.693
40.0	.0209	.148	2.081	.9792	4.524	98.10	21.684			44.00		15.00	.692
50.0	.0214	.169	2.528	.9747	4.545	102.60	22.575			44.50		15.50	.687
60.0	.0217	.189	2.951	.9705	4.565	105.30	23.067			44.75		15.75	.665
70.0	.02195	.211	3.418	.9658	4.587	107.55	23.447			45.00		16.00	.682
80.0	.0221	.229	3.801	.9620	4.605	108.99	23.648			45.00		16.00	.677
110.0	.0226	.289	5.075	.9493	4.667	113.40	24.298			44.75		15.75	.648
140.0	.0231	.344	6.243	.9376	4.776	117.90	24.686			44.50		15.50	.628

Remarks ______________________ AASHO = A-7-6(12) Tested By ______________________
Per Cent Consolidated = 75.3

Saturated At ______________ Drained 12.7 cc's Change in Length Dial .066 − .025 = .041
Change in Weight 668.6 − 663.7 = 4.9 Consolidation Time ______________ Hrs.
Soil Description Gray mottled silty clay with fine sand pockets throughout sample

Form R-310
Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I 15 Proj. No. I-15-7(85)315 File No. ____ Test No. 3 Date February 4, 1971

Drill Hole 11 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ____ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 36.5 PSI Par. B ____ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
170.0	.0235	.400	7.432	.9257	4.786	121.50	25.387			44.00		15.00	.591
185.0	.0237[5]	.430	8.069	.9193	4.818	123.75	25.685			44.00		15.00	.884
260.0	.0246	.567	10.978	.8902	4.976	131.40	26.407			43.00		14.00	.530
290.0	.0250	.622	12.146	.8785	5.043	135.00	26.770			43.00		14.00	.523
320.0	.0253[5]	.677	13.314	.8689	5.098	138.15	27.099			42.50		13.50	.498
350.0	.0257[5]	.729	14.419	.8558	5.176	141.75	27.386	64.035		42.25		13.25	.484
380.0	.0260[5]	.783	15.565	.8444	5.246	144.45	27.535	4.61		42.00		13.00	.472

Remarks ____ AASHO = ____ Tested By ____

Per Cent Consolidated = ____

Saturated At ____ Drained ____ cc's Change in Length Dial ____ − ____ = ____

Change in Weight ____ − ____ = ____ Consolidation Time ____ Hrs.

Soil Description ____

192

Form R-... Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No. I 15-7(85)315 File No. ______ Test No. 4 Date February 3, 1971
Drill Hole 11 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.684 Wet Density 118 Dry Density 90
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 36.5 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top 1.95	1.70 1.80	57.1	50.0	7.1	T-328 24.7	25.3		28.1
Middle 2.10	2.20 2.00	52.7	46.6	6.1	T-304 24.8	21.8		28.0
Bottom 2.25	2.00 2.00	51.3	45.0	6.3	T-329 24.8	20.2		31.2
	T-303	50.2	44.2	6.0	24.8	19.4	30.9	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP =
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔ U =
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.100								21.00			
.20	$.0103^{3}$	.101	.021	.9998	4.431	3.15	.711			22.75		1.75	2.461
2.0	.0115	.106	.128	.9987	4.436	13.50	3.043			25.00		4.00	1.314
5.0	.0131	.114	.298	.9970	4.443	27.90	6.280			28.25		7.25	1.154
10.0	.0153	.131	.661	.9934	4.459	47.70	10.697			32.75		11.75	1.098
15.0	.0169	.145	.960	.9904	4.413	62.10	13.883			35.00		14.00	1.008
20.0	.0182	.158	1.238	.9875	4.486	73.80	16.451			37.00		16.00	.973
30.0	.0198	.182	1.750	.9825	4.509	88.20	19.561			39.25		18.25	.933
40.0	$.0205^{5}$	.205	2.241	9776	4.532	94.95	20.951			40.75		19.75	.943
50.0	.0211	.227	2.711	.9729	4.553	99.90	21.942			41.25		20.25	.923
60.0	$.0214^{5}$	.246	3.116	.9688	4.573	103.05	22.534			41.75		20.75	.921
70.0	$.0217^{5}$	.268	3.586	.9641	4.595	105.75	23.014			42.00		21.00	.912
100.0	.0223	.327	4.846	.9515	4.656	110.70	23.775			42.50		21.50	.904
130.0	.0228	.384	6.063	.9394	4.716	115.20	24.427			42.75		21.75	.890
160.0	.0232	441	7.280	.9272	4.778	118.80	24.864			42.75		21.75	.875

Remarks ______________________ AASHO = A-6(8) Tested By ______________
Per Cent Consolidated = 97.3
Saturated At ______________ Drained 10.8 cc's Change in Length Dial .094 − .028 = .066
Change in Weight 652.8 − 639.7 = 13.1 Consolidation Time ______________ Hrs.
Soil Description Gray mottled silty clay with fine sand pockets throughout entire sample

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 9

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ______ Test No. 4 Date February 3, 1971

Drill Hole 11 Depth 35.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 36.5 PSI Par. B _____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
190.0	.0236	.495	8.432	.9157	4.838	122.4	25.300			42.25		21.25	.840
265.0	.0245	.631	11.336	.8866	4.997	130.5	26.116			41.75		20.75	.795
295.0	.0249	.685	12.489	.8751	5.062	134.1	26.492			41.75		20.75	.783
325.0	.0253	.740	13.663	.8634	5.131	137.7	26.837			41.50		20.50	.764
355.0	.0257	.793	14.793	.8521	5.199	141.3	27.178	63.788		41.25		20.25	.745
385.0	.0260	.852	16.054	.8395	5.277	144.0	27.288	4.59		41.00		20.00	.733

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

TRIAXIAL TEST RESULTS

Test No. 1, Series 10 Drill Hole Sta. 16 + 53 Sample Depth 24'

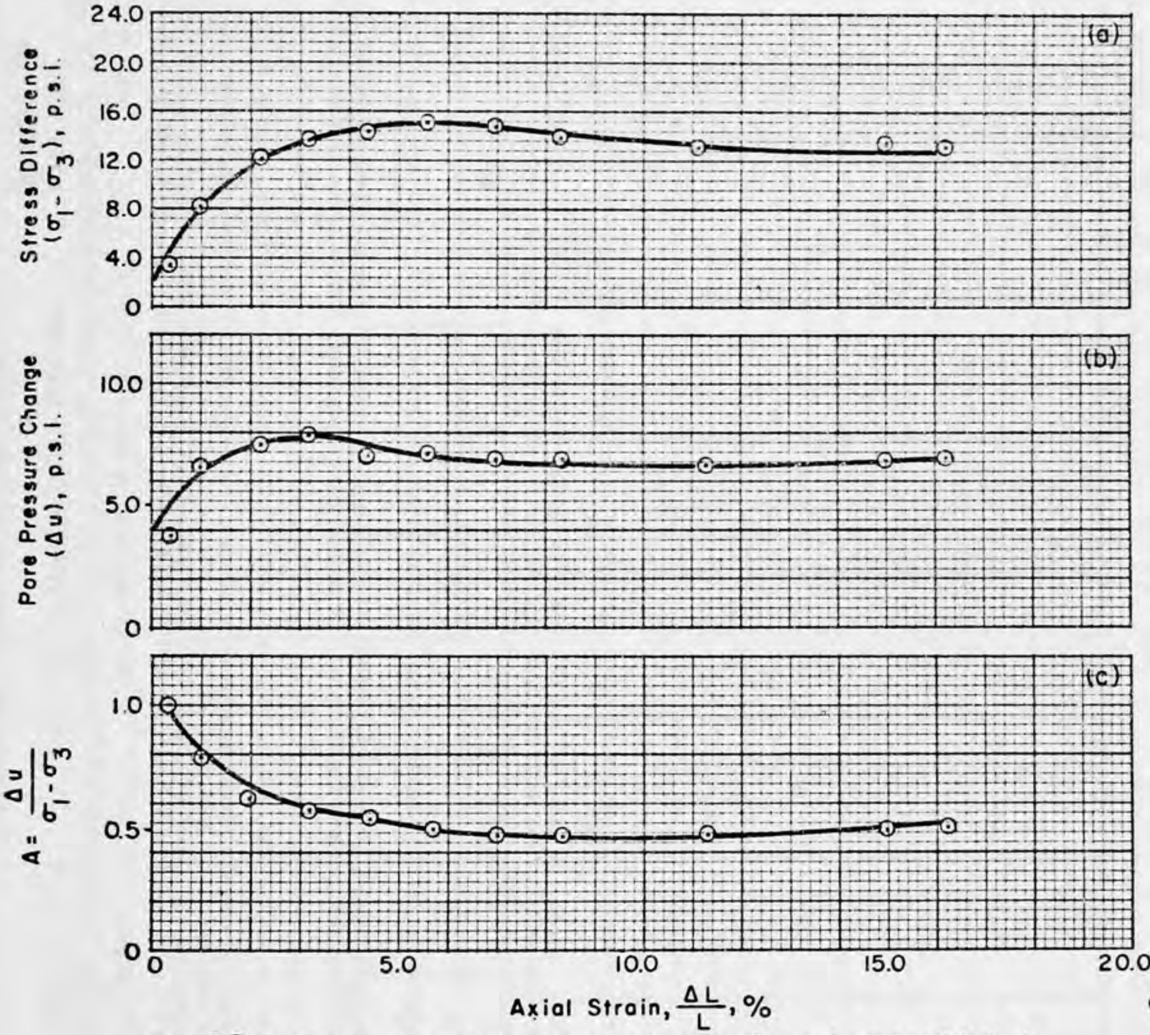

Fig. 38 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date February 19, 197?
Drill Hole 14 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.73 Wet Density 105 Dry Density 7?
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 13.0 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-317	84.7	64.4	20.3	24.9	39.5	51.4	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta P =$ 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta U =$ 20.0
Elapsed Time, min-sec.	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								21.25			
.20	.0102	.051	.021	.9998	4.431	1.80	.406			22.00			
2.0	.0109	.056	.126	.9987	4.436	8.10	1.826			23.00		1.75	.958
5.0	.0118	.065	.317	.9968	4.444	16.20	3.645			25.00		3.75	1.029
10.0	.0129	.079	.613	.9939	4.457	26.10	5.856			26.25		5.00	.854
20.0	.0143	.104	1.142	.9886	4.481	38.70	8.636			28.00		6.75	.782
30.0	.0154	.132	1.735	.9827	4.508	48.60	10.781			28.50		7.25	.672
40.0	.0160^{5}	.155	2.221	.9778	4.530	54.45	12.020			28.75		7.50	.624
50.0	.0166^{5}	.177	2.687	.9731	4.552	59.85	13.148			29.00		7.75	.589
60.0	.0170	.197	3.111	.9689	4.572	63.00	13.780			29.00		7.75	.962
70.0	.0171	.220	3.597	.9640	4.595	63.90	13.906			28.75		7.50	.539
80.0	.0174	.240	4.020	.9598	4.616	66.60	14.428			28.75		7.50	.520
90.0	.0175	.260	4.443	.9556	4.636	67.50	14.560			28.25		7.00	.481
120.0	.0177	.318	5.670	.9435	4.696	69.30	14.757			28.25		7.00	.474
150.0	.0177^{5}	.377	6.919	.9308	4.759	69.75	14.656			28.25		7.00	.478

Remarks ______ AASHO = A-7-5(11) Tested By ______
Per Cent Consolidated = 90.4
Saturated At ______ Drained 9.4 cc's Change in Length Dial .054 − .030 = .024
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description Gray to dark gray varved silty clay with some fine sand.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date February 19, 1971

Drill Hole 14 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 13.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
180.0	$.0177^5$	.443	8.315	.9169	4.831	69.75	14.438			28.00		6.75	.468
195.0	$.0177^5$	.466	8.802	.9120	4.857	69.75	14.308			28.00		6.75	.472
255.0	$.0177^5$	.582	11.256	.8874	4.992	69.75	13.972			28.00		6.75	.483
285.0	$.0177^5$	.640	12.484	.8752	5.062	69.75	13.779			28.00		6.75	.490
315.0	$.0177^5$	.698	13.711	.8629	5.134	69.75	13.586			28.25		7.00	.515
345.0	$.0177^5$	.760	15.023	.8498	5.213	69.75	13.380			28.25		7.00	.523
405.0	.0177	.819	16.271	.8373	5.291	69.30	13.098			28.25		7.00	.534

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______

Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date February 25, 197
Drill Hole 14 Depth 24.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.71 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.0 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top 1.16 1.30 1.30	T-331	66.4	54.0	12.4	24.9	29.1		42.6
Middle .80 1.0 1.0	T-321	60.3	48.4	11.9	24.9	23.9		49.8
Bottom 1.15 1.0 1.12	T-306	63.8	51.7	12.1	24.6	27.1		44.6
	T-327	59.2	47.8	114	24.9	22.9	49.8	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma\Delta P =$ 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma\Delta U =$ 20.0
Elapsed Time, min-sec.	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.075								52.00			
20"	.0103^5	.076	.021	.9998	4.431	3.15	.711			53.00		1.00	1.406
2.0	.0108	.081	.127	.9987	4.436	7.20	1.623			53.75		1.75	1.078
5.0	.0112^5	.090	.318	.9968	4.444	11.25	2.532			54.25		2.25	.889
10.0	.0120	.103	.595	.9941	4.456	18.00	4.039			55.00		3.00	.743
20.0	.0130	.131	1.190	.9881	4.483	27.00	6.023			56.00		4.00	.664
30.0	.0138	.157	1.749	.9826	4.508	34.20	7.586			56.25		4.25	.560
40.0	.0144	.180	2.231	.9777	4.531	39.60	8.746			56.75		4.75	.543
50.0	.0149	.202	2.699	.9730	4.553	44.10	9.686			57.00		5.00	.516
60.0	.0152	.227	3.230	.9677	4.598	46.80	10.223			57.00		5.00	.489
70.0	.0155	.248	3.676	.9632	4.599	49.50	10.763			57.00		5.00	.465
100.0	.0160	.311	5.015	.9499	4.664	54.00	11.578			57.00		5.00	.432
130.0	.0164	.374	6.354	.9364	4.731	57.60	12.175			57.00		5.00	.411
160.0	.0165^5	.439	7.736	.9226	4.802	58.95	12.276			57.00		5.00	.407
190.0	.0166	.500	9.032	.9097	4.870	59.40	12.197			56.50		4.50	.369

Remarks ______ AASHO = A-7-6(10) Tested By ______
Per Cent Consolidated = 22.0
Saturated At ______ Drained 16.4 cc's Change in Length Dial .075 − .030 = .045
Change in Weight ______ − ______ = ______ Consolidation Time 41 minutes ______ Hrs.
Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 2 Date February 25, 1971
Drill Hole 14 Depth 24.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.0 PSI Par. B ___ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P$ =
Pore Pressure Increment psi													$\Sigma\Delta U$ =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
265.0	.0168	.654	12.306	.8769	5.052	61.20	12.114			56.00		4.0	.330
295.0	.0168[5]	.713	13.560	.8644	5.125	61.65	12.029			56.00		4.0	.333
325.0	.0168[5]	.774	14.856	.8514	5.203	61.65	11.849			56.00		4.0	.338
355.0	.0169[5]	.835	16.153	.8385	5.283	62.55	11.840			56.00		4.0	.338

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date February 16, 19
Drill Hole 14 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.705 Wet Density 113 Dry Density 79
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location		Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr	Water Content Before Test %	Water Content After Test %
Top	.95	.90 .90							
Middle	.95	.95 .85							
Bottom	1.35	1.10 1.25							
		T-330	79.7	63.1	16.6	24.8	38.3	43.3	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0						ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0						ΣΔ U = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.						

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	1 − ϵ	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.075								38.50			
.20	$.0103^{5}$	$.0757^{5}$	.015	.9998	4.431	3.15	.711			39.50		1.00	1.406
2.0	.0109	.078	.063	9994	4.433	8.10	1.827			40.00		1.50	.821
5.0	.0120	$.083^{5}$	.180	.9982	4.438	18.00	4.056			41.00		2.50	.616
10.0	.0134	$.092^{5}$	.370	.9963	4.446	30.60	6.883			42.25		3.75	.545
20.0	.0152	.110	.743	.9926	4.463	46.30	10.486			45.00		6.50	620
30.0	.0170	.129	1.147	.9885	4.482	63.00	14.056			46.50		8.00	.569
40.0	.0179	.146	1.509	.9840	4.498	71.00	15.807			48.00		9.50	.601
50.0	.0187	.165	1.912	.9809	4.516	78.30	17.338			49.00		10.50	.626
60.0	.0190	.182	2.274	.9773	4.533	81.00	17.869			49.50		11.00	.616
70.0	.0191	.200	2.656	.9734	4.551	81.90	17.996			50.25		11.75	.653
80.0	$.0191^{25}$	.220	3.081	.9692	4.571	82.13	17.967			50.25		11.75	.634
90.0	$.0191^{5}$	.242	3.549	.9645	4.593	82.35	17.929			50.75		12.25	.683
100.0	$.0191^{5}$	.261	3.953	.9605	4.612	82.35	17.856			51.00		12.50	.700
160.0	$.0191^{5}$	.387	6.631	.9337	4.746	82.35	17.351			52.00		13.50	.778

Remarks ______ AASHO = A-6(9) Tested By ______

Per Cent Consolidated = 54.9

Saturated At 20.0 P.S.I. Drained 12.7 cc's Change in Length Dial .071 − .026 = .045
Change in Weight 625.7 − 615.4 = 10.3 Consolidation Time 1 hr. + 40 min. Hrs.
Soil Description Top 1/2 gray silty clay; bottom 1/2 black organic silty clay with some fine sand

Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 3 Date February 16, 1971
Drill Hole 14 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.0 PSI Par. B ___ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
190.0	.0191^5	.445	7.863	.9214	4.808	82.35	17.128			52.50		14.00	.817
220.0	.0191^5	.500	9.032	.9097	4.870	82.35	16.910			52.75		14.25	.843
250.0	.0191^5	.560	10.308	.8969	4.939	82.35	16.673			53.00		14.50	.870
280.0	.0191^5	.623	11.647	.8835	5.014	82.35	16.424			53.00		14.50	.883
310.0	.0191^5	.682	12.901	.8710	5.085	82.35	16.192			53.25		14.75	.911
340.0	.0191^5	.744	14.218	.8598	5:164	82.35	15.947			53.25		14.75	.925
370.0	.0191^5	.804	14.494	.8551	5.181	82.35	15.895			53.25		14.75	.928

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ - ___ = ___
Change in Weight ___ - ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

201

Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date February 11, 197
Drill Hole 14 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.677 Wet Density 117 Dry Density 86
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.0 PSI Par. B ______ Str. Rate .002"/min

Specimen Location		Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	1.10	1.05 1.30	67.5	57.2	10.3	T-331 24.9	32.3		31.9
Middle	1.15	1.80 1.20	63.1	53.8	9.3	T-306 24.6	29.2		31.8
Bottom	1.15	1.25	54.5	47.5	7.0	T-336 24.9	22.6		31.0
		T-301	68.6	57.0	11.6	24.9	32.1	36.1	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	:100								21.00			
20"	$.0104^{5}$	.101	.021	.9998	4.431	4.05	.914			21.75		.75	.821
3.0	.0126	.108	.171	.9983	4.438	23.40	5.273			26.50		5.50	1.043
5.0	.0137	.116	.342	.9966	4.445	33.30	7.492			28.25		7.25	.968
10.0	.0167	.131	.662	.9934	4.459	60.30	13.523			33.25		12.25	.906
15.0	.0189	.143	.919	.9908	4.471	80.10	17.915			37.50		16.50	.921
20.0	.0202	.156	1.197	.9880	4.484	91.80	20.473			40.00		19.00	.928
25.0	.0209	.167	1.432	.9857	4.494	98.10	21.829			42.00		21.00	.962
30.0	.0213	.179	1.689	.9831	4.506	101.70	22.570			42.25		21.25	.942
40.0	$.0217^{5}$	.202	2.180	.9782	4.529	105.75	23.350			44.50		23.50	1.006
50.0	.0219	.226	2.694	.9731	4.552	107.10	23.528			45.75		24.75	1.052
60.0	.0220	.247	3.143	.9686	4.574	108.00	23.612			46.00		25.00	1.059
75.0	.0220	.277	3.784	.9622	4.604	108.00	23.458			46.00		25.00	1.066
85.0	.0220	.298	4.233	.9577	4.626	108.00	23.346			47.75		26.75	1.146
115.0	.0220	.361	5.580	.9442	4.692	108.00	23.018			49.00		28.00	1.216

Remarks ______ AASHO = A-6(9) Tested By ______

Per Cent Consolidated = 97.6

Saturated At ______ Drained 25.4 cc's Change in Length Dial .097 − .024 = .073

Change in Weight 647.2 − 626.0 = 21.2 Consolidation Time ______ Hrs.

Soil Description Gray silty clay with vertical and horizontal fine sandy seams and small pebbles

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 10

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 4 Date February 11, 197
Drill Hole 14 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 41.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
145.0	.0220[5]	.421	.9314	4.756	108.45	22.803				49.00		28.00	1.228
175.0	.0220[5]	.483	.9181	4.825	108.45	22.477				49.25		28.25	1.257
205.0	.0220[5]	.544	.9051	4.894	108.45	22.160				50.00		29.00	1.309
270.0	.0220[5]	.674	.8773	5.050	108.45	21.475				50.50		29.50	1.374
300.0	.0220[5]	.734	.8645	5.124	108.45	21.165				51.00		30.00	1.417
330.0	.0220[5]	.793	.8515	5.201	108.45	20.852				51.00		30.00	1.439
360.0	.0220[5]	.852	.8392	5.279	108.45	20.544				51.00		30.00	1.460

Remarks ___ AASHO= ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

TRIAXIAL TEST RESULTS

Test No. 1, Series II Drill Hole Sta. 16 + 53 Sample Depth 29'

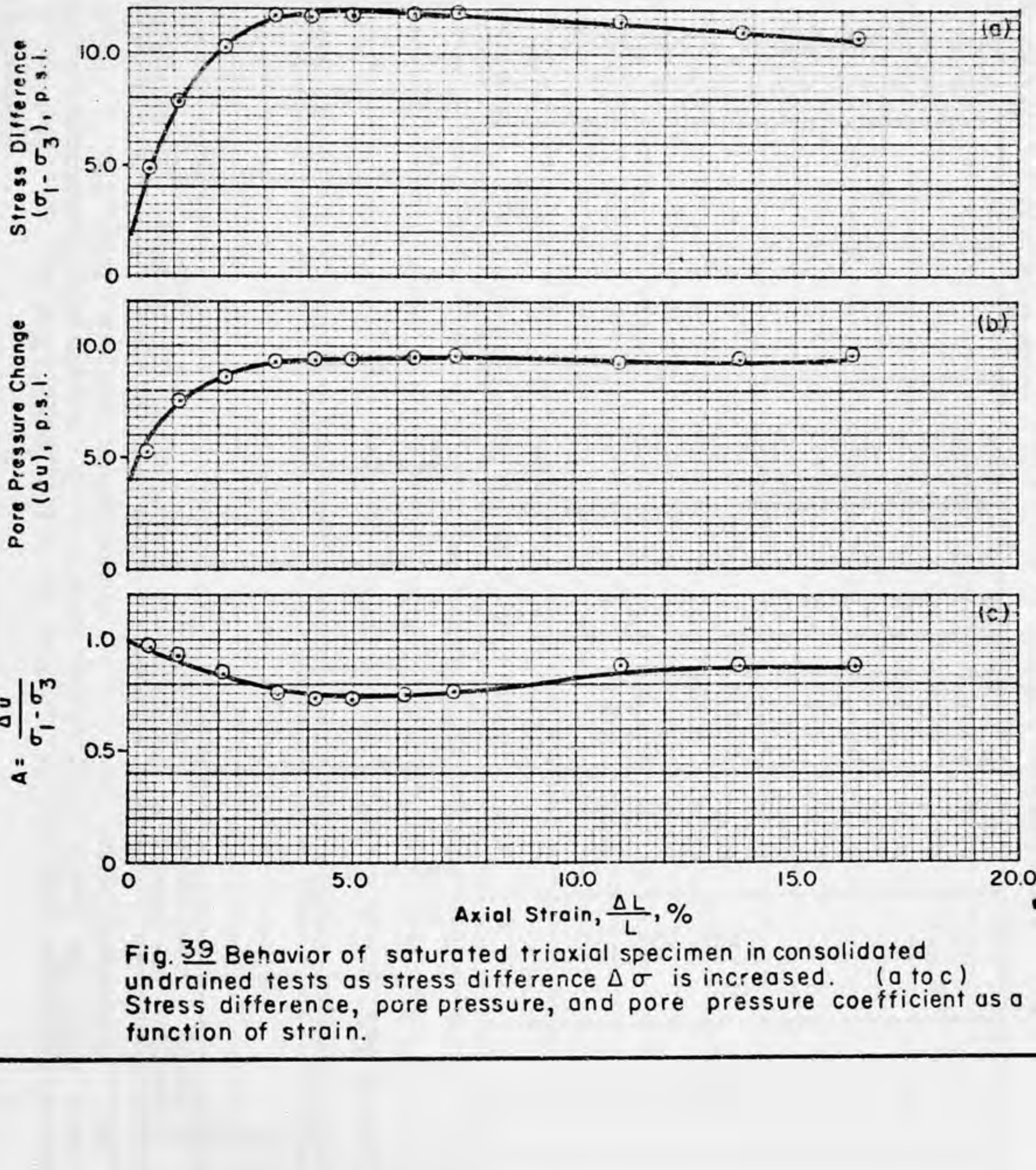

Fig. 39 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta \sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date March 8, 1971
Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.703 Wet Density 113 Dry Density 8
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 16.0 PSI Par. B ______ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	J-333	83.1	67.3	15.8	24.8	42.5	37.2	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.075								21.25			
20"	.0102	.076	.021	.9998	4.431	1.80	.41			21.75		.50	1.231
2.0	.0112	.082	.149	.9990	4.437	10.80	2.43			23.25		2.00	.822
5.0	.0120	.090	.319	.9970	4.444	18.00	4.05			25.50		4.25	1.049
9.0	.0128	.100	.532	.9950	4.454	25.20	5.66			26.75		5.50	.972
19.0	.0140	.129	1.148	.9890	4.481	36.00	8.03			28.75		7.50	.934
29.0	.0147	.155	1.701	.9830	4.507	42.30	9.39			29.50		8.25	.879
39.0	.0153	.179	2.211	.9780	4.530	47.70	10.53			30.00		8.75	.831
49.0	.0158	.203	2.722	.9730	4.554	52.20	11.46			30.50		9.25	.807
59.0	.0161	.227	3.232	.9680	4.578	54.90	11.99			30.50		9.25	.771
69.0	.0162	.249	3.700	.9630	4.600	55.80	12.13			30.50		9.25	.763
79.0	.0162^5	.268	4.104	.9590	4.620	56.25	12.18			30.50		9.25	.760
89.0	.0163	.271	4.593	.9540	4.643	56.70	12.21			30.50		9.25	.757
99.0	.0163^5	.313	5.061	.9490	4.666	57.15	12.25			30.50		9.25	.755
129.0	.0163^5	.376	6.400	.9360	4.733	57.15	12.08			30.50		9.25	.766

Remarks ______ AASHO = A-6(9) Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained 13.4 cc's Change in Length Dial .077 − .030 = .041
Change in Weight ______ − ______ = ______ Consolidation Time 30½ hrs. ______ Hrs.
Soil Description ______

Form R-370
Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date March 8, 1971

Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 16.0 PSI Par. B ____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure increment psi													$\Sigma\Delta P =$
Pore Pressure increment psi													$\Sigma\Delta U =$
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
149.0	.01635	.418	7.293	.927	4.779	57.15	11.96			30.50		9.25	.773
234.0	.01635	.597	11.100	.889	4.983	57.15	11.47			30.50		9.25	.807
264.0	.01635	.657	12.380	.876	5.056	57.15	11.30			31.00		9.75	.863
294.0	.01635	.719	13.690	.863	5.133	57.15	11.13			31.00		9.75	.876
324.0	.01635	.782	15.030	.850	5.214	57.15	10.96			31.00		9.75	.889
354.0	.01635	.844	16.350	.836	5.296	57.15	10.79			31.00		9.75	.904

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______

Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date March 2, 1971

Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.716 Wet Density 110 Dry Density 7

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 40.5 PSI Par. B ______ Str. Rate .002 "/mir

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	90 75 80	62.7	50.3	12.4	T-325 24.8	25.5		48.6
Middle	80 65 75	63.4	52.2	11.2	T-330 24.8	27.4		40.9
Bottom	85 90 90	60.1	50.0	10.1	T-328 24.7	25.3		39.9
	T-322	57.2	46.7	10.5	24.6	22.1	47.5	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma \Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.075								52.75			
20"	.0109	.076	.021	.9998	4.431	8.10	1.83			53.75		1.00	.547
2.0	.0112	.080	.106	.9990	4.435	10.80	2.44			54.75		2.00	.821
6.0	$.0117^5$	.092	.360	.9960	4.446	15.75	3.54			54.75		2.00	.565
10.0	.0122	.102	.573	.9940	4.456	19.80	4.44			54.75		2.00	.450
20.0	.0131	.128	1.124	.9890	4.480	27.90	6.23			55.00		2.25	.361
30.0	.0140	.155	1.696	.9830	4.506	36.00	7.99			55.00		2.25	.282
40.0	.0146	.178	2.184	.9780	4.529	41.40	9.14			55.00		2.25	.246
50.0	.0150	.200	2.651	.9730	4.551	45.00	9.89			55.00		2.25	.228
60.0	$.0152^5$	.219	3.053	.9690	4.570	47.25	10.34			54.75		2.00	.193
70.0	$.0154^5$	.243	3.562	.9640	4.594	49.05	10.68			54.75		2.00	.187
80.0	$.0155^5$	.264	4.008	.9600	4.615	49.95	10.82			54.75		2.00	.185
110.0	.0157	.330	5.407	.9460	4.683	51.30	10.95			54.75		2.00	.183
140.0	$.0157^5$	.389	6.658	.9330	4.746	51.75	10.90			54.50		1.75	.160
170.0	.0158	.446	7.867	.9210	4.808	52.20	10.86			55.00		2.25	.207

Remarks ______ AASHO= A-7-6(13) Tested By ______

Per Cent Consolidated= 19.1

Saturated At ______ Drained 13.0 cc's Change in Length Dial .064 - .030 = .034

Change in Weight 605.8 - 594.6 = 11.2 Consolidation Time ______ Hrs.

Soil Description Light gray to dark gray varved silty clay with alternating fine sand lenses.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date March 2, 1971

Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 40.5 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
250.0	.0158	.598	11.09	.889	4.983	52.2	10.48			54.75		2.00	.191
280.0	.0158	.657	12.34	.877	5.054	52.2	10.33			55.00		2.25	.218
310.0	.0158	.715	13.57	.864	5.126	52.2	10.18			55.00		2.25	.221
340.0	.0158	.775	14.84	.852	5.202	52.2	10.03			55.00		2.25	.224
370.0	.0158	.831	16.03	.840	5.276	52.2	9.89			55.00		2.25	.227

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

Form R-370
Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date February 26, 1971

Drill Hole 14 Depth 29.0' Dia. 4.43 Area 4.75 Length 4.75 Length After Consolidation 4.565 Wet Density 106 Dry Density 71

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 40.5 PSI Par. B ______ Str. Rate .002 "/min.

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	98 98 98	58.8	48.1	10.7	T-333 24.8	23.3		45.9
Middle	98 98 90	56.1	46.8	9.3	T-329 24.8	22.0		42.3
Bottom 1.15	~~1.10 1.15~~ T-317	~~58.13~~ 57.4	~~48.0~~ 46.7	~~10.13~~ 10.7	~~T-301 24.9~~ 24.9	~~23.1~~ 21.8	49.1	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0						ΣΔP = 20
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0						ΣΔU = 20
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.						

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.200								26.00			
.20	.0105	.201	.022	.9998	4.431	4.50	1.02			27.00		1.00	.985
2.0	.0115	.206	.131	.9990	4.436	13.50	3.04			28.50		2.50	.821
6.0	.0133	.220	.468	.9960	4.449	29.70	6.67			32.25		6.25	.936
10.0	.0145	.228	.613	.9940	4.457	40.50	9.09			36.25		10.25	1.128
20.0	.0168	.252	1.139	.9860	4.481	61.20	13.66			40.25		14.25	1.043
35.0	.0181	.286	1.884	.9810	4.515	72.90	16.15			44.50		18.50	1.146
40.0	.0183	.296	2.103	.9790	4.525	74.70	16.51			46.00		20.00	1.212
50.0	.0186	.320	2.629	.9740	4.550	77.40	17.01			47.00		21.00	1.234
61.0	.0187^5	.342	3.111	.9696	4.572	78.75	17.22			48.25		22.25	1.292
75.0	.0188	.371	3.746	.9630	4.602	79.20	17.21			50.00		24.00	1.395
105.0	.0188^5	.434	5.126	.9490	4.669	79.65	17.06			50.50		24.50	1.436
125.0	.0188^5	.494	6.440	.9360	4.735	79.65	16.82			51.75		25.75	1.531
165.0	.0188^5	.554	7.775	.9220	4.802	79.65	16.59			52.25		26.25	1.583
230.0	.0188^5	.684	10.602	.8940	4.955	79.65	16.07			54.00		28.00	1.742

Remarks ______ AASHO = A-7-6(16) Tested By ______

Per Cent Consolidated = 85.2

Saturated At ______ Drained 29.5 cc's Change in Length Dial .212 − .027 = .185

Change in Weight 583.7 − 556.7 = 27.0 Consolidation Time ______ Hrs.

Soil Description Light gray and dark gray varvel silty clay with alternating fine sand lenses

Form R-5?? Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 3 Date February 26, 1971
Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.57 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 40.5 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
260.0	.01885	.743	11.895	.881	5.03	79.65	15.84			53.00		27.00	1.704
290.0	.01885	.801	13.165	.868	5.10	79.65	15.61			54.00		28.00	1.793
310.0	.01885	.862	14.502	.855	5.18	79.65	15.37			54.25		28.25	1.838
340.0	.01885	.921	15.794	.842	5.26	79.65	15.14			54.25		28.25	1.866
360.0	.01885	.961	16.670	.833	5.32	79.65	14.98			54.25		28.25	1.886
390.0													

Remarks ___ AASHO= ___ Tested By ___
Per Cent Consolidated= ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

Form R-370
Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over I-15 & UPRR Proj. No. I-15-7 (85)315 File No. ___ Test No. 4 Date March 4, 1971
Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.63 Wet Density 113 Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 40.5 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location		Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	1.20	1.15 1.20	58.8	49.9	8.9	T-336 24.9	25.0		35.6
Middle	1.15	1.15 1.15	59.3	50.4	8.9	T-323 24.8	25.6		34.8
Bottom	1.15	1.10 1.20	55.9	47.8	8.1	T-321 24.9	22.9		35.4
		T-335	102.5	80.8	21.7	24.6	56.2		38.6

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.150								21.00			
.20	.0105	.153	.065	.999	4.433	4.50	1.02			21.75		.75	.739
2.0	.0118	.157⁵	.162	.998	4.437	16.20	3.65			24.75		3.75	1.027
5.0	.0135	.166	.346	.997	4.445	31.50	7.09			28.00		7.00	.988
10.0	.0151	.180	.648	.994	4.459	45.90	10.29			33.00		12.00	1.166
20.0	.0173	.205	1.189	.988	4.483	65.70	14.65			39.50		18.50	1.262
30.0	.0188	.231	1.751	.982	4.509	79.20	17.57			43.00		22.00	1.252
40.0	.0194	.253	2.226	.978	4.531	84.60	18.67			45.00		24.00	1.285
50.0	.0197	.274	2.680	.973	4.552	87.30	19.18			45.25		24.25	1.264
60.0	.0198	.295	3.134	.969	4.573	88.20	19.29			46.75		25.75	1.335
70.0	.0199	.315	3.566	.964	4.594	89.10	19.40			48.00		27.00	1.392
100.0	.2010⁵	.376	4.884	.951	4.657	91.35	19.61			49.00		28.00	1.428
130.0	.2030	.436	6.181	.938	4.722	92.70	19.63			49.00		28.00	1.426
160.0	.2040	.493	7.413	.926	4.785	93.60	19.56			49.75		28.75	1.470
190.0	.2040⁵	.551	8.667	.913	4.850	94.05	19.39			50.00		29.00	1.496

Remarks ___ AASHO = A-6(12) Tested By ___

Per Cent Consolidated = 97.5

Saturated At ___ Drained 30.1 cc's Change in Length Dial .162 − .039 = .123

Change in Weight 623.0 − 596.2 = 26.8 Consolidation Time 86.0 Hrs.

Soil Description Light gray to dark gray varved silty clay with alternating fine sand lenses.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 11

Project Name Parrish Lane over I-15 & UPRR Proj. No I 15-7(85)315 File No. ______ Test No. 4 Date March 4, 1971

Drill Hole 14 Depth 29.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 40.5 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi														$\Sigma\Delta P=$
Pore Pressure Increment psi														$\Sigma\Delta U=$
Elapsed Time, min-sec														

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
250.0	.0206	.669	11.217	.888	4.990	95.4	19.12			49.75		28.75	1.504
280.0	.0207	.723	12.384	.876	5.045	96.3	19.05			50.50		29.50	1.549
310.0	.0208	.779	13.594	.864	5.127	97.2	18.96			50.75		29.75	1.569
340.0	.0208	.835	14.804	.852	5.200	97.2	18.69			50.75		29.75	1.592
370.0	.0208	.890	15.993	.840	5.273	97.2	18.43			50.75		29.75	1.614

Remarks ______ AASHO= ______ Tested By ______

Per Cent Consolidated= ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ − ______ = ______

Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

TRIAXIAL TEST RESULTS

Test No. 1, Series 13 Drill Hole Sta. 22 + 30 Sample Depth 24'

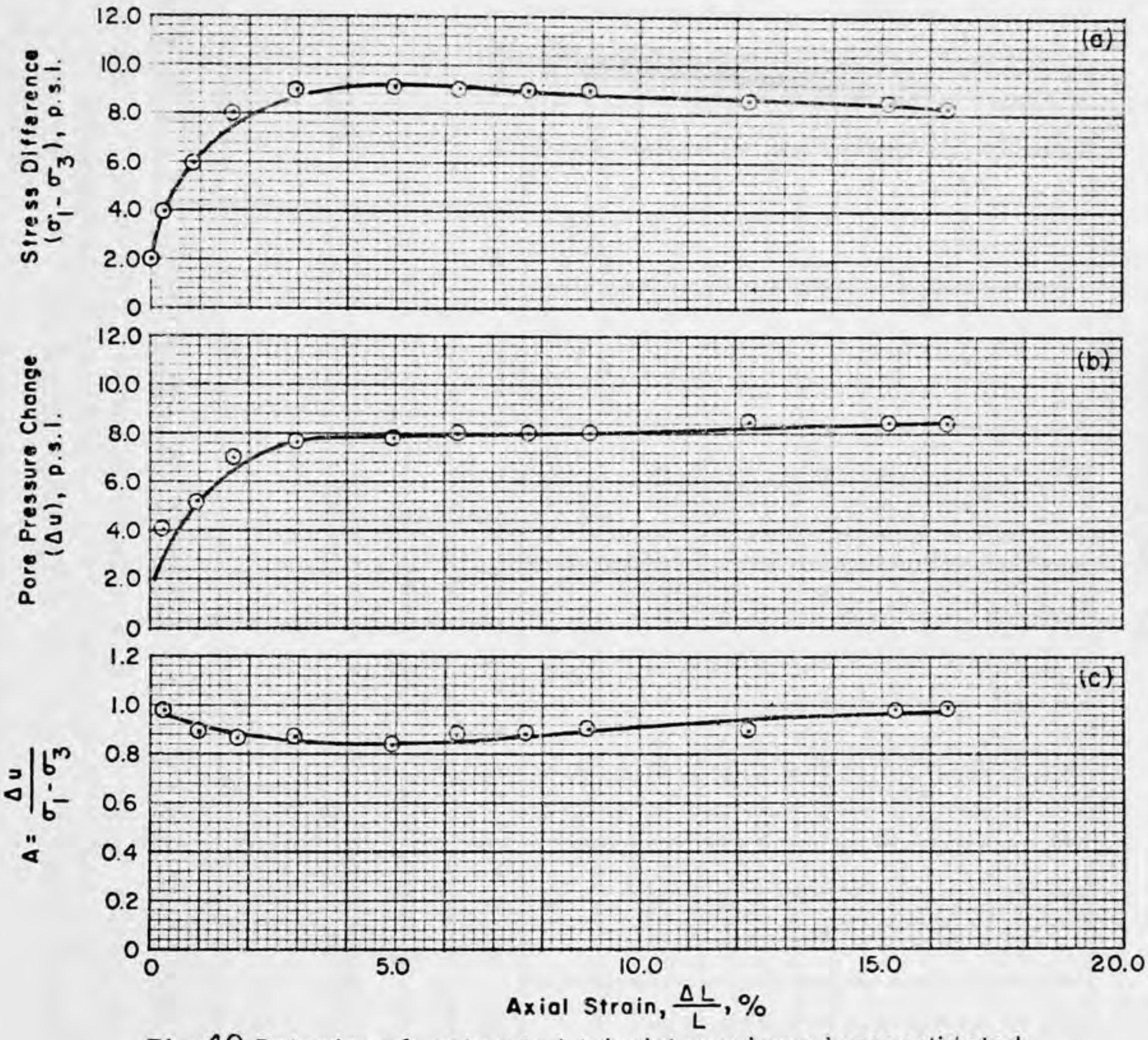

Fig. 40 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta \sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date March 17, 1971
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.716 Wet Density 113 Dry Density 81
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 13.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-301	81.0	65.1	15.9	24.9	40.2	39.6	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.050								21.00			
20"	.0105	.052	.0424	.9996	4.432	4.50	1.015			21.25		0.25	.246
2.0	.0114	.059	.1908	.9981	4.438	12.60	2.839			23.25		2.25	.793
5.0	.0120	.067	.3605	.9964	4.446	18.00	4.049			25.00		4.00	.988
10.0	.0126	.081	.6573	.9934	4.459	23.40	5.247			25.75		4.75	.905
15.0	.0130	.094	.9300	.9907	4.472	27.00	6.038			26.25		5.25	.870
20.0	.0134	.107	1.2080	.9879	4.484	30.60	6.824			27.25		6.25	.916
30.0	.0140	.132	1.7390	.9826	4.508	36.00	7.985			28.00		7.00	.877
40.0	.0143	.156	2.2470	.9775	4.532	38.70	8.539			28.50		7.50	.878
50.0	.0144	.178	2.7140	.9729	4.554	39.60	8.696			28.50		7.50	.862
60.0	.0145	.198	3.1380	.9686	4.574	40.50	8.885			28.75		7.75	.875
70.0	.0145⁵	.222	3.6470	.9635	4.598	40.95	8.907			28.75		7.75	.870
100.0	.0146⁵	.288	5.0470	.9495	4.665	41.85	8.970			28.75		7.75	.864
130.0	.0147	.351	6.3830	.9362	4.732	42.30	8.939			29.00		8.00	.895
160.0	.0147⁵	.417	7.7820	.9222	4.804	42.75	8.899			29.00		8.00	.899

Remarks ______ AASHO = A-6(9) Tested By ______
Per Cent Consolidated = ______
Saturated At ______ Drained 16.3 cc's Change in Length Dial .059 − .025 = .034
Change in Weight ______ − ______ = ______ Consolidation Time ______ Hrs.
Soil Description Gray to black varved organic clay.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date March 17, 1971
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 13.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												$\Sigma\Delta P=$
Pore Pressure Increment psi												$\Sigma\Delta U=$
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
190.0	.0147[5]	.481	9.139	.9086	4.876	42.75	8.768			29.00		8.00	.912
265.0	.0148	.633	12.362	.8764	5.055	43.20	8.546			29.50		8.50	.995
295.0	.0148	.703	13.846	.8615	5.142	43.20	8.401			29.25		8.25	.982
325.0	.0148	.768	15.225	.8478	5.226	43.20	8.267			29.25		8.25	.998
355.0	.0148	.825	16.433	.8357	5.301	43.20	8.149			29.25		8.25	1.012

Remarks ______ AASHO= ______ Tested By ______
Per Cent Consolidated= ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______
Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______

Form R-370
Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date March 16, 1971

Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.731 Wet Density 114 Dry Density 81

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 22.7 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top .35	.35 .40	65.5	54.2	11.3	T-302 24.7	29.5		38.3
Middle .35	.35 .35	63.5	53.0	10.5	T-332 24.8	28.2		37.2
Bottom .50	.50 .50	58.1	49.3	8.8	T-321 24.9	24.4		36.1
	T-303	64.1	52.9	11.2	24.8	28.1	39.9	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0100	.050								34.25			
20"	.0102	.051	.021	.999	4.431	1.80	.406			35.00		0.75	1.846
2.0	.0107	.055	.106	.999	4.435	6.30	1.421			35.50		1.25	.880
5.0	.0112	.063	.275	.997	4.442	10.80	2.431			36.00		1.75	.720
10.0	.0119	.075	.528	.995	4.454	17.10	3.840			36.75		2.50	.651
15.0	.0125	.087	.782	.992	4:465	22.50	5.039			37.00		2.75	.546
20.0	.0128	.097	.993	.990	4.474	25.20	5.632			37.00		2.25	.488
30.0	.0134	.121	1.501	.985	4.497	30.60	6.804			37.75		3.50	.514
43.0	.0139	.150	2.114	.979	4.526	35.10	7.756			38.00		3.75	.484
53.0	.0140	.163	2.389	.976	4.538	36.00	7.932			38.00		3.75	.473
63.0	.0141	.192	3.001	.970	4.567	36.90	8.080			38.00		3.75	.464
73.0	.0141	.206	3.297	.967	4.581	36.90	8.055			38.00		3.75	.466
103.0	.0141[5]	.265	4.542	.955	4.641	37.35	8.048			38.00		3.75	.466
133.0	.0141[5]	.329	5.894	.941	4.707	37.35	7.934			38.50		4.25	.536
163.0	.0141[5]	.375	6.865	.931	4.757	37.35	7.852			38.75		4.50	.573

Remarks ______ AASHO = A-6(11) Tested By ______

Per Cent Consolidated = 37.2

Saturated At ______ Drained 15.3 cc's Change in Length Dial .054 - .035 = .019

Change in Weight ______ - ______ = ______ Consolidation Time 3 hours Hrs.

Soil Description Gray to black varved silty clay with fine sandy seams

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 2 Date March 16, 1971
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.731 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 22.7 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma\Delta P=$
Pore Pressure Increment psi													$\Sigma\Delta U=$
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
253.0	.0142	.532	10.182	.898	4.932	37.8	7.664			39.00		4.75	.620
283.0	.0142	.589	11.386	.886	4.999	37.8	7.561			39.00		4.75	.628
313.0	.0142	.647	12.611	.874	5.069	37.8	7.457			39.00		4.75	.637
343.0	.0142	.700	13.730	.863	5.135	37.8	7.361			39.00		4.75	.645
373.1	.0142	.757	14.935	.851	5.208	37.8	7.258			39.00		4.75	.654

Remarks ___ AASHO= ___ Tested By ___
Per Cent Consolidated= ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ____ Test No. 3 Date March 24, 1971
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.70 Wet Density 111 Dry Density 7
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 22.7 PSI Par. B ____ Str. Rate .002 "/min

Specimen Location		Container Number		Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.		Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	.65	.60	.60	60.0	49.5	10.5	T-328	24.7	24.8		42.3
Middle	.50	.55	.50	63.3	52.3	11.0	T-311	24.7	27.6		39.9
Bottom	.60	.60	.60	62.15	51.75	10.4	T-305	24.9	26.85		38.7
		T-316		72.5	58.5	14.0		24.8	33.7	41.5	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1−ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.075								31.00			
20"	.0106	.076	.021	.9998	4.431	5.40	1.22			32.00		1.00	.821
2.0	.0112	.083	.170	.9980	4.438	10.80	2.43			33.50		2.50	1.027
5.0	.0120	.091	.341	.9970	4.445	18.00	4.05			34.00		3.00	.741
10.0	.0125	.104	.617	.9940	4.458	22.50	5.05			35.00		4.00	.792
15.0	.0130	.118	.915	.9910	4.411	27.00	6.04			36.00		5.00	.828
20.0	.0134	.132	1.213	.9880	4.484	30.60	6.82			36.25		5.25	.769
30.0	.0139	.154	1.682	.9830	4.506	35.10	7.79			36.75		5.75	.738
40.0	.0141	.176	2.150	.9780	4.527	36.90	8.15			37.25		6.25	.767
50.0p	.0143	.198	2.619	.9740	4.549	38.70	8.51			38.00		7.00	.823
60.0	.0144	220	3.087	.9690	4.571	39.60	8.66			38.00		7.00	.808
70.0	.0145	.243	3.577	.9640	4.594	40.50	8.82			38.00		7.00	.794
80.0	.0145⁵	.265	4.045	.9600	4.617	40.95	8.87			38.00		7.00	.789
140.0	.0148	.389	6.685	.9330	4.747	43.20	9.10			38.25		7.25	.797
170.0	.0148⁵	.455	8.090	.9190	4.820	43.65	9.06			38.50		7.25	.828

Remarks ______ AASHO = A-4(8) Tested By ______
Per Cent Consolidated = 51.5
Saturated At ______ Drained 20.5 cc's Change in Length Dial .078 − .025 = .053
Change in Weight 616.6 − 597.1 = 19.5 Consolidation Time 4 hrs. & 10 min. Hrs.
Soil Description Light gray to dark gray varved organic clay with alternating horizontal fine sandy seams

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 3 Date March 24, 1971
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 22.7 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													$\Sigma \Delta P =$
Pore Pressure Increment psi													$\Sigma \Delta U =$
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	i − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
200.0	.0149	.519	9.45	.905	4.892	44.1	9.01			38.75		7.75	.860
230.0	.0150	.580	10.75	.892	4.964	45.0	9.07			38.75		7.75	.855
260.0	.0150	.642	12.07	.879	5.038	45.0	8.93			38.75		7.75	.868
290.0	.0150	.704	13.39	.866	5.115	45.0	8.80			38.50		7.50	.852
320.0	.0150	.764	14.67	.853	5.192	45.0	8.67			39.00		8.00	.923
350.0	.0150	.823	15.93	.841	5:269	45.0	8.54			38.75		7.75	.907

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

Form R-370
Rev. 4-70
Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date February 26, 19[illegible]
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.554 Wet Density 108 Dry Density 74
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 22.7 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location		Container Number		Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.		Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	1.15	1.25	1.0	57.1	47.7	9.4	T-305	24.9	22.8		41.2
Middle	.95	.90	.90	52.75	44.4	8.35	T-313	24.8	19.6		42.6
Bottom	1.10	.95	.90	58.1	48.4	9.7	T-328	24.7	23.7		40.9
		T-314		75.3	59.4	15.9		24.9	34.5	46.1	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma \Delta P =$ 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								$\Sigma \Delta U =$ 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0100	.200								21.25			
20"	.0106	.202	0.044	.9996	4.432	5.40	1.218			22.00		0.75	0.616
2.0	.0118	.208	0.176	.9982	4.438	16.20	3.650			24.75		3.50	0.959
5.0	.0129	.217	0.375	.9963	4.447	26.10	5.869			27.00		5.75	0.980
10.0	.0139	.230	0.659	.9934	4.459	35.10	7.871			29.00		7.75	0.985
15.0	.0144	.243	0.944	.9906	4.472	39.60	8.855			30.75		9.50	1.073
20.0	.0147	.254	1.186	.9881	4.483	42.30	9.435			32.00		10.75	1.139
30.0	.0150	.278	1.713	.9829	4.507	45.00	9.984			33.00		11.75	1.177
40.0	.0153^5	.302	2.240	.9776	4.531	48.15	10.626			34.00		12.75	1.200
50.0	.0155	.323	2.701	.9730	4.553	49.50	10.872			34.75		13.50	1.242
60.0	.0157	.346	3.206	.9679	4.577	51.30	11.209			35.25		14.00	1.249
70.0	.0158^5	.366	3.645	.9635	4.598	52.65	11.452			36.50		15.25	1.332
80.0	.0160	.388^5	4.139	.9586	4.621	54.00	11.685			36.50		15.25	1.305
90.0	.0160^5	.412	4.655	.9534	4.646	54.45	11.717			36.50		15.25	1.301
120.0	.0163	.478	6.105	.9390	4.718	56.70	12.018			37.00		15.75	1.311

Remarks ______ AASHO= ______ Tested By ______
Per Cent Consolidated = 94.5
Saturated At 20.0 p.s.i. Drained 35.5 cc's Change in Length Dial .221 − .025 = 0.196
Change in Weight 594.2 − 558.0 = 36.2 Consolidation Time 69 hrs. & 10 min. Hrs.
Soil Description Light gray to dark gray varved clay with alternating horizontal fine sandy seams.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 13

Project Name Parrish Lane over UPRR & I-15 Proj. No I-15-7(85)315 File No. ___ Test No. 4 Date February 26, 19
Drill Hole 13 Depth 24.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 22.7 PSI Par. B ___ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	i − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
150.0	.0165	.543	7.532	.9247	4.791	58.50	12.211	34.913		37.00		15.75	1.290
180.0	.0166	.606	8.915	.9108	4.864	59.40	12.213	2.514		37.50		16.25	1.331
245.0	.0168	.739	11.836	.8816	5.025	61.20	12.180			37.75		16.50	1.355
275.0	.0168[5]	.805	13.285	.8671	5.109	61.65	12.068			37.75		16.50	1.367
305.0	.0169	.866	14.625	.8538	5.189	62.10	11.968			37.75		16.50	1.379
335.0	.0169	.928	15.986	.8401	5.273	62.10	11.777			37.75		16.50	1.401

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___

TRIAXIAL TEST RESULTS

Test No. 1, Series 14 Drill Hole Sta. 16 + 53 Sample Depth 20'

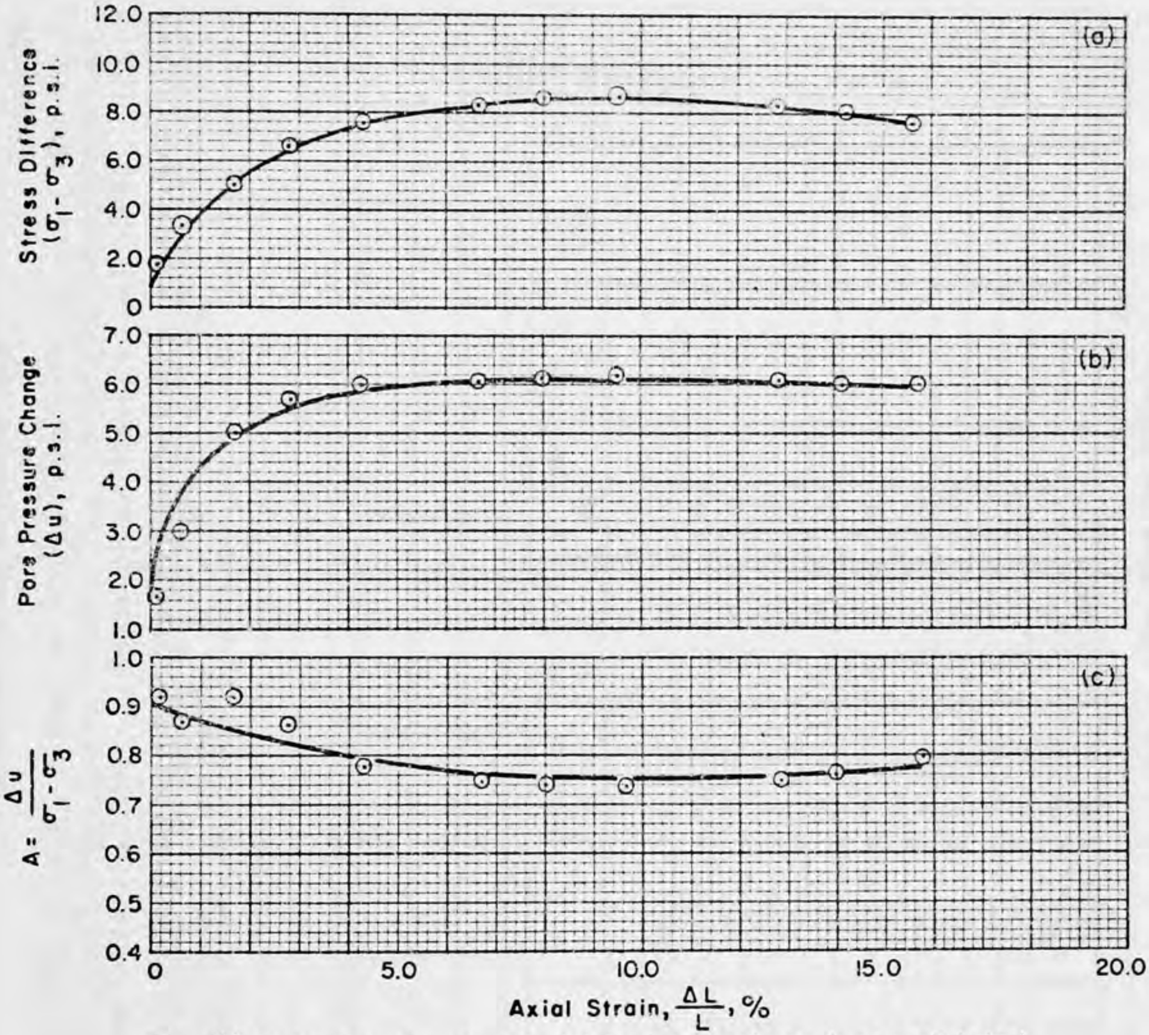

Fig. 41 Behavior of saturated triaxial specimen in consolidated undrained tests as stress difference $\Delta\sigma$ is increased. (a to c) Stress difference, pore pressure, and pore pressure coefficient as a function of strain.

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date April 2, 1971
Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.69 Wet Density 109 Dry Density 7
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 11.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0069	.100								21.00			
20''	.0073	.1015	.032	.999	4.431	3.60	.81			21.50		0.50	.615
2.0	.0077	.107	.149	.999	4.437	7.20	1.62			22.50		1.50	.924
5.0	.0082	.115	.320	.997	4.444	11.70	2.63			23.00		2.00	.760
10.0	.0086	.129	.618	.994	4.460	15.50	3.43			24.00		3.00	.874
15.0	.0089	.145	.960	.990	4.470	18.00	4.02			24.75		3.75	.931
20.0	.0092	.159	1.258	.987	4.490	20.70	4.61			25.25		4.25	.921
30.0	.0096	.184	1.791	.982	4.510	24.30	5.39			26.00		5.00	.928
40.0	.0100	.209	2.325	.977	4.540	27.90	6.15			26.25		5.25	.853
50.0	.01025	.231	2.794	.972	4.560	30.15	6.62			26.75		5.75	.869
60.0	.0105	.256	3.327	.967	4.580	32.40	7.07			27.00		6.00	.848
70.0	.0107	.280	3.839	.962	4.610	34.20	7.42			27.00		6.00	.808
80.0	.0109	.302	4.308	.957	4.630	36.00	7.78			27.00		6.00	.772
90.0	.0111	.323	4.756	.952	4.650	37.80	8.15					6.00	.738
130.0	.0113	.413	6.675	933	4.750	39.60	8.34			27.25		6.25	.749

Remarks ______________________ AASHO = A-7-6(10) Tested By ______________________
Per Cent Consolidated = ______________________
Saturated At 20.0 P.S.I. Drained 14.0 cc's Change in Length Dial .086 − .025 = .061
Change in Weight ______ − ______ = ______ Consolidation Time 64 Hrs.
Soil Description Gray to black mottled clay with an organic silty fine sand. Pocket on bottom of sample.

Form R-370
Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 1 Date April 2, 1971
Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.69 Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 11.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
160.0	.0115	.479	8.08	.919	4.82	41.4	8.59			27.25		6.25	.728
190.0	.0115	.548	9.55	.904	4.90	41.4	8.45			27.25		6.25	.739
260.0	.0115	.701	12.82	.872	5.08	41.4	8.15			27.25		6.25	.767
290.0	.0115	.766	14.20	.858	5.16	41.4	8.02			27.25		6.25	.779
320.0	.0115	.833	15.63	.844	5.25	41.4	7.88			27.25		6.25	.793

Remarks ______________ AASHO = ______ Tested By ______________
Per Cent Consolidated = ______
Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______
Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.
Soil Description ______________

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 2 Date April 1, 1971
Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.713 Wet Density 108 Dry Density 75
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 23.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	35 30 30	64.5	52.2	12.3	T-310 25.0	27.2		45.2
Middle	35 30 30	59.6	48.6	11.0	T-332 24.8	23.8		46.2
Bottom	50 50 50	54.2	45.4	8.8	T-316 24.8	24.6		35.8
	T-333	63.7	51.8	11.9	24.8	27.0	44.1	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta P$ = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							$\Sigma\Delta U$ = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in Inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0067	.050								38.00			
20"	.0072	.051	.021	.9998	4.431	2.70	.609			38.25		.25	.410
2.0	.0075	.057	.149	.9990	4.437	5.40	1.217			39.00		1.00	.822
5.0	.0079	.068	.382	.9960	4.450	9.00	2.020			39.50		1.50	.741
10.0	.0083	.082	.678	.9930	4.460	12.60	2.830			39.75		1.75	.619
15.0	.0088	.096	.976	.9900	4.470	17.10	3.820			39.75		1.75	.458
20.0	.0091	.110	1.273	.9870	4.490	19.80	4.910			39.75		1.75	.397
25.0	.0093^5	.123	1.549	.9850	4.500	22.05	4.900			39.75		1.75	.357
30.0	.0096	.135	1.804	.9820	4.510	24.30	5.390			39.75		1.75	.325
40.0	.0101^5	.159	2.313	.9770	4.530	29.25	6.450			39.75		1.75	.271
50.0	.0105	.184	2.843	.9720	4.560	32.40	7.110			39.75		1.75	.246
60.0	.0106	.207	3.331	.9670	4.580	33.30	7.270			39.75		1.75	.241
70.0	.0107	.229	3.798	.9620	4.608	34.20	7.430			39.75		1.75	.236
80.0	.0107	.251	4.265	.9570	4.630	34.20	7.390			39.75		1.75	.237
110.0	.0107^5	.315	5.620	.9440	4.690	34.65	7.380			39.75		1.75	.237

Remarks ______ AASHO = A-7-6(13) Tested By ______
Per Cent Consolidated = 21.7
Saturated At ______ Drained 14.2 cc's Change in Length Dial .062 − .025 = .037
Change in Weight 599.1 − 589.5 = 9.6 Consolidation Time $1\frac{1}{2}$ Hrs.
Soil Description Light gray to dark gray mottled organic clay

Form R-5?? Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 2 ___ Date April 1, 1971

Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.713 Wet Density ___ Dry Density ___

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 23.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
140.0	.01075	.380	7.00	.930	4.76	34.65	7.27			39.75		1.75	.241
170.0	.01075	.415	8.38	.916	4.84	34.65	7.17			39.75		1.75	.244
260.0	.01075	.638	12.48	.875	5.06	34.65	6.85			39.75		1.75	.256
290.0	.01075	.703	13.86	.861	5.14	34.65	6.74			39.75		1.75	.260
320.0	.01075	.765	15.17	.848	5.22	34.65	6.64			39.75		1.75	.264

Remarks ___ AASHO = ___ Tested By ___

Per Cent Consolidated = ___

Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___

Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.

Soil Description ___

Form R-370
Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date April 8, 1971

Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.693 Wet Density 110 Dry Density 7

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 23.0 PSI Par. B ______ Str. Rate .002 "/mi

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								
	T-308	89.6	69.0	20.6	24.7	44.3	46.5	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔP = 20.0
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0							ΣΔU = 20.0
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.							

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A=\frac{\Delta u}{\sigma_1-\sigma_3}$
0.0	.0070	.100								32.75			
20"	.0071	.1005	.011	.9999	4.430	.90	.203			33.25		.50	2.460
2.0	.0073	.102	.043	.9996	4.432	2.70	.609			34.00		1.25	2.050
5.0	.00765	.106	.128	.9987	4.436	5.85	1.319			34.75		2.00	1.516
10.0	.00815	.116	.341	.9970	4.450	10.35	2.330			35.25		2.50	1.074
15.0	.0084	.123	.490	.9950	4.450	12.60	2.830			36.00		3.25	1.148
20.0	.0086	.135	.746	.9930	4.460	14.40	3.230			36.50		3.75	1.162
25.0	.0088	.145	.959	.9900	4.470	16.20	3.620			37.00		4.25	1.173
30.0	.0090	.154	1.150	.9880	4.480	18.00	4.020			37.00		4.25	1.058
40.0	.0093	.176	1.620	.9840	4.500	20.70	4.600			37.75		5.00	1.088
50.0	.0096	.195	2.020	.9800	4.520	23.40	5.180			38.00		5.25	1.014
60.0	.0098	.215	2.450	.9750	4.540	25.20	5.550			38.25		5.50	.991
120.0	.01075	.3185	4.660	.9530	4.650	33.75	7.260			39.00		6.25	.860
150.0	.0109	.368	5.710	.9430	4.700	35.10	7.470			39.25		6.50	.870
180.0	.0110	.415	6.710	.9330	4.750	36.00	7.580			39.50		6.75	.890

Remarks ______ AASHO = A-6(9) Tested By ______

Per Cent Consolidated = 44.6

Saturated At ______ Drained ______ cc's Change in Length Dial .082 - .025 = 0.057

Change in Weight ______ - ______ = ______ Consolidation Time 3½ Hrs.

Soil Description Light gray to dark gray mottled clay with alternating organic fine sand lenses

Form R-370
Rev. 4-70

Page ___ of ___

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 3 Date April 8, 1971

Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ______ Wet Density ____ Dry Density ____

Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 23.0 PSI Par. B _____ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi												ΣΔP =
Pore Pressure Increment psi												ΣΔU =
Elapsed Time, min-sec												

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	$1-\epsilon$	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
210.0	.0110	.466	7.80	.922	4.80	36.0	7.49			39.50		6.75	.901
240.0	.0111	.514	8.82	.912	4.86	4.86	7.59			39.50		6.75	.889
270.0	$.0111^5$	.560	9.80	.902	4.91	4.91	7.60			39.50		6.75	.888
300.0	$.0111^5$	.607	10.80	.892	4.97	4.97	7.52			39.75		7.00	.931
330.0	.0113	.670								40.00			

Remarks ______ AASHO = ______ Tested By ______

Per Cent Consolidated = ______

Saturated At ______ Drained ______ cc's Change in Length Dial ______ - ______ = ______

Change in Weight ______ - ______ = ______ Consolidation Time ______ Hrs.

Soil Description ______

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION

TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ______ Test No. 4 Date March 30, 1971
Drill Hole 13 Depth 20.0' Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation 4.683 Wet Density 108 Dry Density 7[illegible]
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 23.0 PSI Par. B ______ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top	30 35 35	64.2	52.6	11.8	T-327 24.9	27.7		42.6
Middle	40 40 40	65.0	53.0	12.0	T-309 24.6	28.4		42.3
Bottom	40 35 35	54.8	45.7	9.1	T-319 24.7	21.7		41.9
	T-339	42.1	34.0	8.1	12.0	22.0	36.8	

Back Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔP =
Pore Pressure Increment psi	3.0	3.0	3.0	3.0	3.0	5.0								ΣΔU =
Elapsed Time, min-sec	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.								

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ε %	1 − ε	Area A Sq. in.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
0.0	.0070	.100								25.25			
20"	.0075	.101^{5}	.032	.9997	4.431	4.50	1.02			26.00		.75	.739
2.0	.0083	.108	.171	.9980	4.444	11.70	2.64			27.25		2.00	.759
5.0	.0093	.117	.363	.9960	4.450	20.70	4.66			29.00		3.75	.805
10.0	.0098	.134	.726	.9930	4.460	25.20	5.65			30.25		5.00	.885
15.0	.0103	.147^{5}	1.014	.9900	4.480	29.70	6.64			31.25		6.00	.904
20.0	.0108	.161	1.303	.9870	4.490	34.20	7.62			32.25		7.00	.919
30.0	.0116	.187	1.857	.9810	4.510	41.40	9.17			33.75		8.50	.927
40.0	.0119	.211	2.370	.9760	4.540	44.10	9.72			34.50		9.25	.952
50.0	.0121	.236	2.904	.9710	4.560	45.90	10.06			35.00		9.75	.969
60.0	.0121^{5}	.259	3.395	.9660	4.590	46.35	10.11			35.50		10.25	1.014
70.0	.0121^{5}	.280	3.844	.9620	4.610	46.35	10.06			35.75		10.50	1.044
80.0	.0121^{5}	.301	4.292	.9570	4.630	46.35	10.01			36.00		10.75	1.074
110.0	.0121^{5}	.368	5.723	.9430	4.700	46.35	9.86			36.75		11.50	1.165
140.0	.0121^{5}	.433	7.111	.9290	4.770	46.35	9.72			37.00		11.75	1.209

Remarks ______ AASHO = A-7-6(10) Tested By ______
Per Cent Consolidated = 77.2

Saturated At 20.0 P.S.I. Drained 21.9 cc's Change in Length Dial .092 − .025 = .067
Change in Weight 598.0 − 580.6 = 17.4 Consolidation Time 18.0 Hrs.
Soil Description Light gray and dark gray mottled clay with 1/8" fine sand lense at top of sample

UTAH STATE DEPARTMENT OF HIGHWAYS
MATERIALS & TESTS DIVISION
TRIAXIAL COMPRESSION TEST

Series 14

Project Name Parrish Lane over UPRR & I-15 Proj. No. I-15-7(85)315 File No. ___ Test No. 4 Date March 30, 1971
Drill Hole 13 Depth 20.0 Dia. 2.375 Area 4.43 Length 4.75 Length After Consolidation ___ Wet Density ___ Dry Density ___
Proving Ring No. 81 Calibration Factor 0.90 Consolidation Pressure 23.0 PSI Par. B ___ Str. Rate .002 "/min

Specimen Location	Container Number	Wt. Container & Wet Soil, Gr.	Wt. Container & Dry Soil, Gr.	Wt. Water, Gr.	Wt. Container Gr.	Wt. Dry Soil, Gr.	Water Content Before Test %	Water Content After Test %
Top								
Middle								
Bottom								

Back Pressure Increment psi													ΣΔP =
Pore Pressure Increment psi													ΣΔU =
Elapsed Time, min-sec													

Elapsed Time min.	Prov. Ring 0.0001 in.	Length ΔL in.	Strain ϵ %	1 − ϵ	Area A Sq. In.	Ax. Load p lbs.	Ax. Press psi	σ_1 in psi	$\frac{\sigma_1}{\sigma_3}$	Pore Press u, psi	u in inches of Hg	Δu, psi	$A = \frac{\Delta u}{\sigma_1 - \sigma_3}$
155.0	.0121⁵	.460	7.69	.923	4.80	46.35	9.660			37.00		11.75	1.217
215.0	.0121	.590	10.46	.895	4.95	45.90	9.270			38.00		12.75	1.314
245.0	.0120⁵	.654	11.83	.882	5.02	45.45	9.046			38.00		12.75	1.409
275.0	.0120⁵	.726	13.37	.866	5.11	45.45	8.890			38.00		12.75	1.434
305.0	.0120⁵	.782	14.56	.854	5.19	45.45	8.770			38.00		12.75	1.455
335.0	.0119⁵	.851	16.02	.840	5.27	44.55	8.450			38.00		12.75	1.510

Remarks ___ AASHO = ___ Tested By ___
Per Cent Consolidated = ___
Saturated At ___ Drained ___ cc's Change in Length Dial ___ − ___ = ___
Change in Weight ___ − ___ = ___ Consolidation Time ___ Hrs.
Soil Description ___